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GENERA HYMENOPHYLLACEARUM[1]

By EDWIN BINGHAM COPELAND
Of the University of California, Berkeley

ELEVEN PLATES AND ONE TEXT FIGURE

Whoever devotes long and careful study to a group of plants becomes acquainted with their several significant characteristics and recognizes minor groups. He recognizes the groups of individuals as species, and is usually disposed to regard the definable groups of species as genera. Thus the men who have studied the Hymenophyllaceæ most comprehensively, Presl and van den Bosch, have felt constrained to recognize many genera. Prantl recognized a smaller number of genera, chiefly because he knew a smaller range of species. Hooker and Sadebeck, who cataloged very many species, the former in Species Filicum and Synopsis Filicum, the latter in the Pflanzenfamilien, and who went back to the genus concepts of Swartz, are not exceptions to this rule, because, however many species they may have seen, they did not devote to them the careful and detailed attention necessary to an understanding of significant characteristics and of the affinities which these peculiarities make plain.

I began the detailed study of these ferns without suspecting that it would result in dissatisfaction with the general view that

[1] This paper expresses the general results of intermittent studies carried on since 1908, and for a considerable part of my time since 1928. It has been composed in the Herbarium of the University of California, for the use of the facilities of which I gladly express my sense of obligation. I am indebted to Doctor Maxon for many items of counsel and material assistance, and to Mr. C. V. Morton for a very careful criticism of my manuscript; without committing these gentlemen to my conclusions, I thank them for their help.

two genera compose the family.[2] I knew already that some of Presl's genera, as *Cephalomanes* and *Pleuromanes*, were based on imaginary characteristics, and did not suspect that they nevertheless represented natural groups of species worthy of generic status. With time, my experience was exactly that of van den Bosch:[3] "Speciebus Hymenophyllacearum diligenter et accurate investigatis, generum statuendorum necessitas in dies magis me urget horumque notas et limites sensim melius perspicio." Because this improvement of understanding has been gradual, and

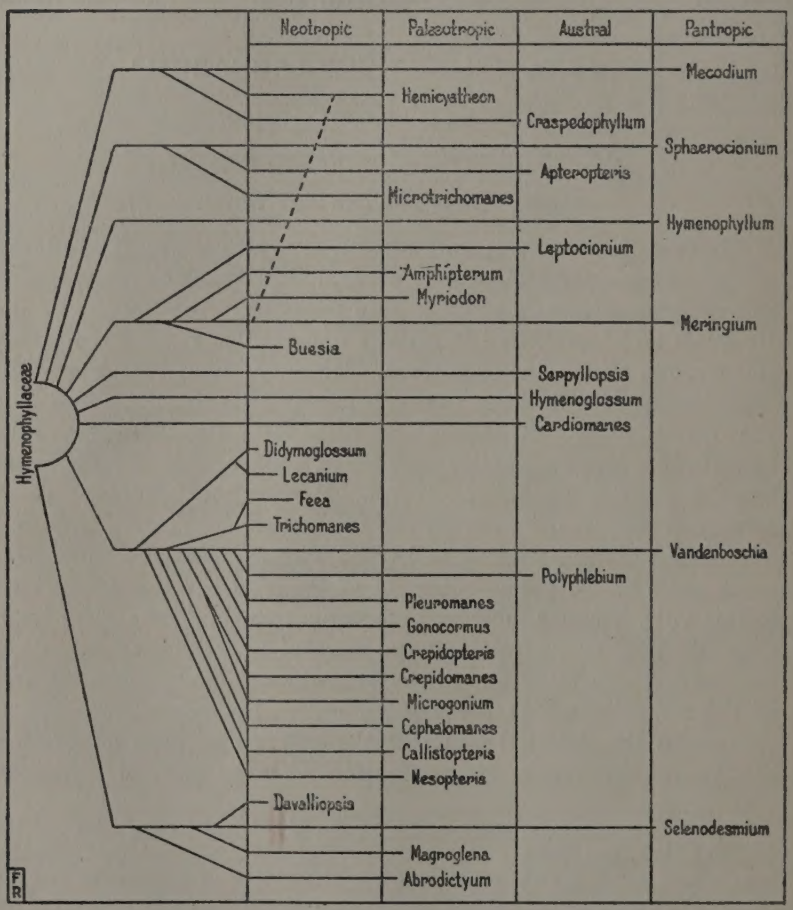


Diagram of affinities of genera.

[2] *Loxsoma* and *Loxsomopsis* are not included in this study.

[3] Hymenophyllaceæ Javanicæ (1861) 5, footnote.

without end, I have abstained from the publication of ideas on genera, until my familiarity with the species is as complete as it seems likely to become. Here, I would again follow van den Bosch,[4] quoting Fries: "Vana sunt nova genera, sine universali specierum cognitione et praecipue morphoseos historia."

Because I have discussed elsewhere[5] in some detail the two principles which must determine the recognition of genera, this phase of an introductory discourse may be treated briefly here. These are:

Naturalness.—A genus must be a natural group. Like a family of men, it must consist of "blood relatives", including all within some accepted measure of affinity, and only these. Such a genus is literally, not figuratively, natural; it exists in nature. Two species of diverse descent (beyond the accepted measure of affinity) do not belong in one genus, though their resemblance may reach apparent identity. In our verbal definitions of genera we use words describing their (usually visible) characteristics; but no such characteristic is fit to serve always as a generic criterion. Phyletic unity, so far as all our evidence lets us recognize it, is the sole categorical test of a genus. Literally speaking, the descendants of a given plant of a century ago are a natural group. The descendants of a plant of a million years ago are a natural group, perhaps, however, represented by several of our species. So also are the descendants of a plant of fifty million or more years ago.

If we knew the genealogies of our plants for these periods, the sole criterion in determining how far back we should go for the common ancestor of a genus would be the other principle:

Convenience.—Subject always to the preceding principle (naturalness), a genus should be delimited with all possible regard to our convenience. In its application, this principle develops several aspects. In the first place, it serves our convenience to establish genera which we can recognize easily by their verbal definitions. Again, it may be convenient to have our genera recognizable by a group of common characters, rather than by some one arbitrary criterion;[6] that is, the natural-

[4] Synopsis (1859) 5.

[5] The Oriental Genera of Polypodiaceæ. Univ. Calif. Publ. Bot. 16 (1929) 45–128.

[6] This may be disputed; but I believe that our comfortable acceptance of genera recognized by arbitrarily chosen criteria is the result of adjustment, by usage, to a procedure which would be uncomfortable without the adjustment.

ness of a genus should be reasonably recognizable. In other cases, it surely serves our convenience to distinguish as genera groups with few or single conspicuous characteristics. Again, very large genera are inconvenient.. *Trichomanes* and *Hymenophyllum* have become inconveniently large genera. "But convenience will not justify us in dividing a genus of a thousand species along any except natural lines; nor let us maintain a genus of two species, unless they are nearly related." [7]

After the removal of several foreign elements *Trichomanes* of Linnæus remained a natural genus. It would be equally natural still, but would be very inconvenient, comprising the whole family. When Sir James Smith removed one species and set up *Hymenophyllum,* the result was two natural genera. However, with time, the two have not merely outgrown convenience, but they also have not remained convenient in other respects, nor even natural. That they have not remained convenient is attested by the number of species that have been referred to both *Trichomanes* and *Hymenophyllum,* because they share their formal articles of definition—consider *Didymoglossum, Meringium, Serpyllopsis.* That in recent time they are not natural, is illustrated best by *Sphaerocionium* and *Microtrichomanes,* together forming a natural group and reasonably forming a genus, but with the former treated as *Hymenophyllum,* the latter as *Trichomanes.*

As to the extent to which convenience is served by the recognition of more and more genera, workers cannot be expected to agree. The convenience of the man who wants merely to find names for his specimens, by the most superficial examination which will satisfy this purpose, is not that of the man who seeks to understand the phylogeny of the groups, by the most careful study of each species. The treatment which serves my convenience has changed essentially with the years of study. I find satisfaction in the fact that most of the genera I recognize are those long since set up or maintained by Presl and van den Bosch. Presl must have had a rather remarkable eye for genera. His diagnostic characters might range from imaginary to fantastic—consider *Cephalomanes, Pleuromanes,* and *Abrodictyum;* but each of these represents a natural genus. As to the number of genera, Presl and I are not far apart. Presl named twenty-nine genera, some of them almost undefined. Van den Bosch described twenty-four. Including two monotypic ge-

[7] Copeland, op. cit., p. 18.

nera and one of two species which they never saw, I recognize thirty-three.

The genera herein maintained or established are those which seem to me to merit recognition, after test by the two principles already presented. The family is diversified beyond the suspicion of those who have not given it particular study. The characteristics involved in this diversification are useful as generic characters whenever, in the evolution of the family, they have become fixed as attributes of natural groups conveniently to be treated as genera. The most careful study of these characteristics was that of Mettenius. Remembering always that naturalness is the indispensable criterion of a genus, and that characteristics are of systematic utility only as they serve to enable us to recognize natural groups,[8] some general discussion of the characters which are, or might be, useful in this family is in order.

The family as a whole is characterized by peculiarities: (*a*) Of the gametophyte, (*b*) of the reproductive structures of the sporophyte, (*c*) of the vegetative structures of the sporophyte.

The spores, so far as known, are uniform throughout the family. They are of the tetrahedral type, with three originally plane surfaces where they were in contact in the spore mother cell, and a convex face. The plane faces become convex, and the angle where they meet becomes inconspicuous. They contain chlorophyll, and commonly germinate very promptly. Most of our information as to the germination of the spores of different genera and species is due to the presence of young gametophytes in the sori of herbarium specimens. It has been assumed that their period of viability after dispersal is brief; but this is relative, and the assumption should be used very cautiously, in drawing conclusions against the possibility of their dissemination over stretches of ocean. The fact that they have so spread outweighs any antecedent improbability of their doing so.

Beginning with the germination of the spores, the gametophytes are known for so few species that it is unsafe to draw general conclusions. In the majority of observed cases the entire cell (spore) divides into three approximately equal cells; this occurs in *Trichomanes crispum*, *T.* (*Cardiomanes*) *reni-*

[8] De natuur kent geene karakters; zij brengt typen voort, wier wezen wij te erkennen en wier verwantschap wij te beoordeelen hebben naar het geheel harer bewerktuiging, zigtbaar in hetgeen wij habitus noemen.—van den Bosch, Eerste Bijdrage (1861) 303.

forme, T. (*Microtrichomanes*) *digitatum, H.* (*Mecodium*) *abruptum, H.* (*Mecodium*) *polyanthos, H.* (*Meringium*) *bivalve, H. tunbridgense, H.* (*Mecodium*) *capillaceum, H.* (*Meringium*) *fusciforme,*[9] *H.* (*Mecodium*) *undulatum* (Hedwig, cited by Mettenius), *H.* (*Mecodium*) *rarum* (Sadebeck), *H.* (*Mecodium*) *dilatatum, T.* (*Microtrichomanes*) *palmatifidum,*[10] and *T.* (*Vandenboschia*) *draytonianum.*[11] In other cases three cells are cut off at the "corners" of the spore, leaving a larger central cell; this occurs in *T.* (*Vandenboschia*) *schmidianum* (Taschner), *T.* (*Crepidopteris*) *humile, T.* (*Vandenboschia*) *pyxidiferum* (Mettenius), and *T.* (*Gonocormus*) *diffusum* (Goebel).

The further development is known for still fewer species. As generalizations, in *"Hymenophyllum"* one of the three original outgrowths develops, after forming a short protonema, into a thalloid structure, one cell thick except along a narrow axis, bearing archegonia in clusters on cushions near the margin, and antheridia in various places. The species observed belong to *Hymenophyllum* and *Sphaerocionium. Cardiomanes* behaves in the same manner (Holloway); and so, I believe, does *Serpyllopsis.* In *"Trichomanes"* the protonema forms an extensively branched structure, ultimately producing thalloid structures which bear the archegonia on short special branches in *T. alatum* (Bower) and *T. sinuosum* (Goebel), or, without thallus, bearing such branches on the branched filament, in *T.* (*Vandenboschia*) *pyxidiferum, T.* (*Gonocormus*) *diffusum, T.* (*Selenodesmium*) *rigidum,* and *T.* (*Macroglena*) *strictum.* Holloway describes the gametophyte of *T.* (*Selenodesmium*) *elongatum,* which "has but a brief filamentous stage, and develops into a large strap-shaped tissue body whose meristem is situated at the base of a sinus at its forward end, the archegonia being borne on a series of cushionlike thickenings behind the meristerm,"[12] whence it appears that this structure varies within *Selenodesmium.* There are a number of observations of other peculiarities. Mettenius reported exceedingly slow growth of the gametophyte of *T. pyxidiferum;* and there are other observations to the same effect. It seems to be of indefinitely long life, and in both known forms to be capable of vegetative multiplication by the dying off of old parts and independent survival of the branches. Infection

[9] Mettenius, Hymen. (1864) 489–491, pl. 4.
[10] Goebel, Organographie 2 (1930) 1089.
[11] Campbell, Mosses and Ferns (1905) 373.
[12] Holloway, Trans. N. Zeal. Inst. (1923).

of the rhizoids by fungi has been observed for several species. A remarkable pitting of the walls is reported for one. The formation of gemmæ seems to be general, and they are of at least two types. Both apogamy and apospory are reported. Goebel reports countless lateral antheridiophore outgrowths from the ribbonlike thallus of *T.* (*Didymoglossum*) *Kraussii.*

The paucity of these observations, and their indiscriminate distribution among the genera I recognize, makes it impossible at this time to use gametophytic characters for the characterization of the genera. With regard to the Polypodiaceæ our information is more extensive, and, aside from the Vittarieæ, there is such uniformity that the gametophyte is valueless in taxonomy. Among the Hymenophyllaceæ so much diversity is known that more complete information seems likely to make the gametophyte very useful in an understanding of the evolution and in the correct classification of the group.

The division of the family into two genera has been based on the form of the involucre (indusium), supposed then to be composed of two mutually free "valves" in *Hymenophyllum,* and to be a tube in *Trichomanes.* The condition ascribed to *Hymenophyllum s. lat.* exists in many species of *Hymenophyllum s. str., Sphaerocionium,* and *Mecodium.* Since the involucre begins at the base of the receptacle, the valves are not free unless the whole sorus protrudes beyond the margin. It is usually more or less immersed, in which case there is at least the beginning of a tube. It is wholly immersed in *H.* (*Sphaerocionium*) *Lyallii,* leaving no free lips, so the species is moved to *Trichomanes; T.* (*Apteropteris*) *Malingii,* equally without free valves, was moved in the other direction. Even if the sorus is not immersed, there is a tubular or obconic base in very many species called *Hymenophyllum*—Presl's *Meringium, Leptocionium,* and others. Conversely, two groups of *"Trichomanes," Crepidomanes* and *Didymoglossum,* have the mouth of the involucre divided into two lips, more deeply so in some species of *Crepidomanes* than in some species of *Meringium.* To provide for these very many species that do not conform to the definition of either genus, Presl and van den Bosch, who recognized many genera, set up intermediate groups of genera, Sectio Didymoglosseæ Presl, and Tribus Leptocioneæ van den Bosch.

At the base of the sorus the fertile vein may give rise to a branch running up each side of the tube; this phenomenon is observed in some but not in all species of *Mecodium, Meringium,*

and *Vandenboschia*. The tube is more than one layer of cells thick in *Trichomanes s. str.* but not in all groups of *Trichomanes s. lat.;* this difference merits detailed study.

The receptacle is typically included—that is, not longer than the involucre—in "*Hymenophyllum;*" of indefinite length, by basal intercalary growth, in *Trichomanes*. In *Trichomanes s. lat.* there is uniformity of type, the globose tip and the inflated base on which respectively Presl based his genera *Cephalomanes* and *Ragatelus* being illusory. The receptacle of *Meringium* and its derivatives and of *Leptocionium* is like that of *Trichomanes*, indefinitely long. That of *Hymenophyllum s. str.* is of the same type but of limited growth, not typically exceeding the involucre. In *Mecodium* and *Sphaerocionium*, growth ceases by the time the sporangia develop, the latter being simultaneous.—*Simplices*, of Bower. In each of these genera there are natural groups of species with cylindrical receptacles, and others with more or less globose receptacles, all having longer or shorter sterile bases. These are illustrated for very many *Mecodium* species in my Hymenophyllum.[13] I place in *Mecodium* some American species with extruded receptacle. The sporangia may be sessile on the body of the receptacle, or may be borne on more or less prominent outgrowths, sporangiophores. Some species produce basal paraphyses.

The sporangia are uniform in type, sessile, with an obliquely transverse annulus interrupted by the stomium. In general they are large, with many superficial cells and up to 256 or 512 potential spores in *Hymenophyllum s. lat.;* small, with few superficial cells and comparatively few spores, in *Trichomanes s. lat.* Bower has studied these most amply, and concludes that species producing very numerous sporangia produce correspondingly small ones. However, *Cardiomanes* bears very long receptacles with indefinitely many sporangia as large as are known in any leptosporangiate fern.

In the range of modifications in vegetative form and structure in adaptation to a generally humid environment, the Hymenophyllaceæ exceed any other family in the plant kingdom. This statement may astound those accustomed to the summary dictum that these are plants of very simple structure, but I make it with confidence. In a humid environment transpiration is limited. The leaf structure, evolved in perfect adaptation to the environment, then demands that the transpiration be lim-

[13] Philip. Journ. Sci. 64 (1937) 1.

ited, and the group is incapable of adaptation to constantly dry environment. In the internal economy of such plants the typical stem plays a minor part. It is a creeping rhizome bearing remote distichous fronds in most genera; this is the primitive stem of the family. In *Trichomanes s. str.*, *Selenodesmium*, *Davalliopsis*, *Nesopteris*, *Callistopteris*, and *Cephalomanes*, it shortens and is ascending or erect, with congested polystichous fronds. The bundle is of the concentric fern type. When, in stem or leaf, it becomes collateral, it does so by reduction, and these collateral bundles are not homologous with those of other plants.

Root bundles are usually diarch, but range from monarch to nonarch. The most remarkable phenomenon as to the roots of the family is their disappearance. Mettenius found them absent in *T.* (*Vandenboschia*) *pyxidiferum* and *schmidianum*, *T.* (*Gonocormus*) *saxifragoides*, *T.* (*Crepidomanes*) *intramarginale*, *latemarginale*, and others, *T.* (*Microgonium*) *cuspidatum* and others, *T.* (*Didymoglossum*) *Petersii* and others, *T.* (*Lecanium*) *membranaceum*, and *T.* (*Crepidopteris*) *humile*. The number of species usually rootless is very large, but a root can occasionally be detected on species normally rootless. Rootlessness in general seems to characterize all of the genera just named in parentheses, with the exception of *Vandenboschia*.

In the absence of roots, stems take their place. These metamorphosed stems may be long, slender, freely branched, with suppression of the leaves. In substitution for root hairs, they produce rhizoides, cut off by a septum at the base. *Hymenophyllum* (*Mecodium*) *axillare* produces similar metamorphosed leafless stems, except that they bear roots. Besides the ordinary functions of absorbing liquid and anchoring the plant, the stout roots of old plants of *Trichomanes s. str.*, *Cephalomanes*, and *Selenodesmium* serve as braces or props, to hold up the erect stems, which are not directly fixed in the ground.

The leaves vary from entire to flabellate, many times dichotomous, and as many as five times pinnatifid. *Cardiomanes* and *Hymenoglossum* have simple fronds of considerable size; those of *Didymoglossum*, *Microgonium*, and *Craspedophyllum* are very small, even down to 5 mm or less long. The minute fronds of *Microgonium* and *Didymoglossum* are flat, not circinate, in vernation, unlike those of any other leptosporangiate ferns. Fronds up to several decimeters long are erect, in the genera with erect stems, or pendant in *Sphaerocionium*, *Mecodium*, and *Vandenboschia*. The systems of branching in the axes of

the fronds are of the same types as in other ferns. Really reticulate venation occurs only in certain species of *Trichomanes*. A marginal vein connects the ends of the veins in most species of *Microgonium*. Besides veins with the usual structure, "false veins" occur. These are placed like veins, and may represent reduced or aborted veins, in *Trichomanes s. str.* spp., *Didymoglossum*, *Lecanium*, and in part in *Microgonium;* or they are structures *sui generis* in no way related to real veins, in *Crepidomanes* and in part in *Microgonium*. These are sometimes distinguished as striæ. There are also marginal structures, presumably protective, loosely spoken of as false veins, characteristic of *Pleuromanes*, *Crepidopteris*, *Craspedophyllum*, and *Hymenoglossum*. The elements of the striæ of *Crepidomanes* are like those surrounding the axes and forming sclerenchymatous sheaths. They are silicified, and in structure are peculiar to the family; Mettenius named them "Deckzellen," 'tapetal cells.'

The family is commonly defined as having the lamina a single cell thick. This is true in general, and precludes the differentiation of the tissues and tissue systems characteristic of other vascular plants. *Cardiomanes* and *Davalliopsis* have leaves uniformly three, four, or five cells thick, as do also *H.* (*Mecodium*) *dilatatum* and *scabrum*. In these cases the superficial cells are essentially like those of the family in general, and the differentiation of the internal cells does not extend beyond some difference in size, and the absence of chlorophyll. There are no intercellular spaces. I do not regard these thick leaves as primitive, but agree with Goebel that they are "tertiary" modifications. Fairly conclusive ontogenetic evidence to this effect is presented by Holloway.[14] The colorless internal cells, without intercellular spaces, would surely not be expected in an intermediate evolutionary stage between the leaf of any ordinary fern and that of *Hymenophyllum*. There are a considerable number of known cases of fronds partly two cells thick. This discussion applies only to the parenchymalike cells; striæ and specialized margins are commonly two or more cells thick.

There are remarkably specialized cell walls, which sometimes serve to characterize genera. Remarkable coarse-bordered pits of essentially the same general design are found in *Selenodesmium* and *Meringium*, with exceptions that may be primitive

[14] Trans. N. Z. Inst. 54 (1923) 587.

in New Zealand but are almost surely tertiary in Malaya. Similar walls occur in some species of *Macroglena*. The most remarkable plant in the family, in the structure of its walls and the form and arrangement of its cells, is *Abrodictyum*.

As to the cell contents, van den Bosch has described them in general terms for a great number of species, but his data have not been found available for the characterization of groups. *Sphaerocionium*, so far as the species have been tested, is remarkable for very small and numerous chromatophores. Remarkably large cells characterize *T.* (*Vandenboschia*) *philippianum* and most species of *Macroglena;* those of *Cephalomanes* also are large.

This is not an exhaustive list of the morphological peculiarities exhibited by members of the family, still less of the groups and species which demonstrate them. Most of our information up to date is the work of Mettenius, comparatively little having been added by Prantl, Giesenhagen, Boodle, Bower, Campbell, and other successors—somewhat more by Goebel.

One of the most unique such features shown by any genus is the loss of distinction between rhizome and stipe in *Gonocormus*. With this exception, proliferation by the frond is rare in the family, confined to *Trichomanes s. str.* and its derived genus *Feea*.

The trichomes of the family merit a separate paragraph, having a taxonomic value which has been too little appreciated. Hairs of one, two, or more cells protecting the apices of stems and very young leaves are general in the family and are usually caducous. They may seem to be attached above the base, and in this case have been called paleæ. Club-shaped bicellular hairs are more persistent in *Nesopteris*, and fringe the mouth of the involucre of two species. Long, soft hairs are common enough to be characteristic of *Trichomanes s. str.* and *Meringium*. In *Pleuromanes* they are borne on the broad axial pad, but not on the unilaminate "parenchyma." Large, stalked, stellate trichomes characterize *Sphaerocionium*, and their modifications are characteristic of the minor groups of that genus. Their stalk cells may disappear, leaving a sessile, stellate cluster of setæ. By further reduction these setæ become paired, and finally single. Such setæ persist on some, not all, species of the derived genus *Microtrichomanes*. They occur also on *Didymoglossum*, but not on *Microgonium*, whether or not the latter has a marginal vein.

Real paleæ, superficially expanded trichomes, such as characterize the *Cyathea-Dryopteris*, *Matonia-Polypodium*, and *Oleandra-Davallia* phyla of Polypodiaceæ, are unknown in Hymenophyllaceæ. The structures so construed in *H.* (*Buesia*) *mirificum* are mostly cut-off fragments of the common wing of the axis, as was recognized by Presl in the case of *H.* (*Ptychophyllum*) *plicatum*.[15] "Stipes bifarie paleaceus vel potius margine frondis utriusque in dentes acuminatos paleae formibus dissoluto instructus." One New Guinea species of the *Meringium* group, with much-crisped (overfull, plicate) lamina, has the whole of the wing of the frond broken up in this manner. It is thus destitute of any venulate green laminar area, a condition so remarkable that I have tried to give it adequate emphasis by constituting it a genus (*Myriodon*), although its relation to *Meringium* is perfectly clear. There is a better known and repeatedly illustrated derivative of *Sphaerocionium*, whose photosynthetic area consists of innumerable short filaments standing out in all directions from the axes; this also is worthily treated as a genus (*Apteropteris*).

While adaptation to a humid environment is the general principle in the evolution of this family, the fact is not to be overlooked that a large part of them are epiphytes, and that epiphytes in general are of necessity able to endure temporary dryness. Polypodiaceous epiphytes, as a generality, are structurally equipped to retain water during temporary outside dryness, but such structural equipment is comparatively rare in Hymenophyllaceæ. The colorless internal cells of *Cephalomanes reniforme*, *H. dilatatum*, and *H. scabrum* seem to serve for water storage. The hairy covering of many species of *Sphaerocionium* is a protection against loss of water. *H.* (*Apteropteris*) *Malingii* is the one plant in the family structurally apparently highly modified to live as an exposed epiphyte. As Giesenhagen emphasized, there are devices of form by which liquid water is conserved outside the leaf.

Most commonly, as I pointed out long ago, the epiphytes of this family are fitted to their environment by enduring the loss of water, as do the mosses, and still more perfectly the lichens. In my experience most species change their form during desiccation, but Holloway [16] reports that *H. rarum* and *H. flabellatum*, and even the prothalli of the former, remain unchanged while

[15] Hymenophyllaceæ (1843) 121.
[16] Trans. N. Z. Inst. 54 (1923) 591.

the moss they grow in curls up with dryness. Shreve [17] has reported concentration of the cell sap amounting to nearly or quite half-normal salt.

The bad state of the nomenclature of these plants has been remarked upon repeatedly, sometimes by those who contributed to the evil. Thus Prantl [18] could note "die in einem heillosen Zustande befindliche Synonymik," but deliberately reject *Feea* and *Cephalomanes* in favor of later names. Giesenhagen described the taxonomy of a part of the family as "eine ausserordentliche Verwirrung," and "ein wirres Durcheinander."

I have tried to bring order into the generic nomenclature by a scrupulous observance of the accepted rules, the essential principle of which is that any group now treated as a genus must bear the oldest tenable generic name of any species now included in it. Such a species is the type species of the genus, and the generic name cannot be dissociated from it. This rule is exceptionally easy to apply in this family because the older and larger genera were mostly described originally, each with a single species, leaving no chance for difference of opinion as to the type.

The generic names proposed for these plants are shown in chronological order, by the following enumeration. For convenience I include, but indent, the names imperfectly proposed for genera, or proposed for groups of infrageneric rank. The type species is given in each case. The genera retained are in boldface type.

Trichomanes Linnæus (1737). *T. crispum.*

Pyxidaria Gleditsch (1764). (This name has no status at all.)

Achomanes Necker (1790) = *Trichomanes.*

Hymenophyllum Smith (1793). *H. tunbridgense.*

Ptychomanes Hedwig (1800) = *Hymenophyllum.*

Feea Bory (1824). *F. nana* Bory = *F. botryoides* (Kaulf.) v. d. B.

Hymenostachys Bory (1824). *H. elegans* (Rudge) = *Trichomanes diversifrons* (= *Feea*).

Didymoglossum Desvaux (1827). *D. muscoides* Desv. (= *Trichomanes hymenoides*).

Lecanium Presl (1843). *L. membranaceum* (L.) Presl.

Cardiomanes Presl (1843). *C. reniforme* (Forster) Presl.

Achomanes Presl (1843) = *Trichomanes.*

Eutrichomanes Presl (1843). Included spp. of *Didymoglossum*, *Sphaerocionium*, *Gonocormus*, *Crepidomanes*, and many others, but not *Trichomanes crispum.*

[17] Bot. Gaz. 51 (1911) 204.

[18] Hymenophyllaceæ (1875) 53.

Pachychaetum Presl (1843). *Trichomanes luschnatianum* Presl = *T. rupestre.*

Ragatelus Presl (1843). *R. crinitus* (Sw.) = *Trichomanes.*

Cephalomanes Presl (1843). *C. atrovirens.*

Neurophyllum Presl (1843), *non* T. & G. (1840). *N. Vittaria* (D. C.) = *Trichomanes.*

Microgonium Presl (1843). *M. cuspidatum* (Willd.).

Abrodictyum Presl (1843). *A. Cumingii* ("*Habrodictyon* Presl" v. d. B.).

Chilodium Presl (1843). *D. Neesii* (Blume) = *Meringium.*

Crepidium Presl (1843), *non* Blume 1825. *D. humile* (Forster) = *Crepidopteris.*

Meringium Presl (1843). *M. Meyenianum.*

Hemiphlebium Presl (1843). *H. pusillum* (Sw.) = *Didymoglossum.*

Leptocionium Presl (1843). *L. dicranotrichum.*

Myrmecostylum Presl (1843). *M. tortuosum* = *Meringium.*

Ptychophyllum Presl (1843). *P. plicatum* = *Meringium.*

Sphaerodium Presl (1843). *Hymenophyllum Wilsoni* Hooker.

Euhymenophyllum Presl (1843), incl. *Hymenophyllum tunbridgense.*

Cyclogossum Presl (1843). *Hymenophyllum caespitosum* Gaud. = Serpyllopsis.

Craspedophyllum Presl (1843). *Hymenophyllum marginatum.*

Sphaerocionium Presl (1843). *S. hirsutum* (Sw.).

Hymenoglossum Presl (1843). *H. cruentum* (Cav.).

Homoeotes Presl (1848). *H. heterophylla* (H. B. W.) = *Feea.*

Macrogloena Presl (1848). *Trichomanes meifolium.*

Pseudochomanes Presl (1849–1851). *Trichomanes sinuosum* Rich. = *Trichomanes.*

Odontomanes Presl (1849–1851). *O. Hostmannianum* (Kl.) = *Trichomanes.*

Crepidomanes Presl (1851). *C. intramarginale* (H. & G.).

Pleuromanes Presl (1851). *P. acutum.*

Taschneria Presl (1851). *T. Filicula* (Bory) = *Crepidomanes.*

Leucomanes Presl (1851). *L. album* (Blume) = *Pleuromanes.*

Amphipterum Presl (1851). *A. fuscum* (Blume).

Mecodium Presl (1851). *M. sanguinolentum* (Forster).

Dermatophlebium Presl (1851). *D. tomentosum* (Kze.) = *Sphaerocionium.*

Neuromanes Trevisan (1851). *N. affine* = *Trichomanes hostmannianum.*

Tetralasma Philippi (1860). *Hymenophyllum quadrifidum.*

Craspedoneuron van den Bosch (1859–1861). *C. album* (Blume) = *Pleuromanes.*

Phlebodium van den Bosch (1859), *non* J. Sm. (1841). *Trichomanes venosum.*

Serpyllopsis van den Bosch (1859–1861). *S. antarctica* = *S. caespitosa* (Gaud.) C. Chr.

Diploophyllum van den Bosch (1859–1861), *non Diplophyllum* Lehm. (1814). *Hymenophyllum dilatatum* = *Mecodium.*

Gonocormus van den Bosch (1861). *G. minutus* (Blume).

Adiantopsis van den Bosch (1861), *non* Fee (1850) { *Trichomanes Pricurii* = *T. elegans.*

Davallopsis van den Bosch (1861).

Lacostea van den Bosch (1861); Prantl (1875). *Trichomanes Ankersii* = *Trichomanes.*

Maschalosorus van den Bosch (1861). *M. Mougeotii* v. d. B. = *Feea osmundoides.*

Phlebiophyllum van den Bosch (1861), *non Phlebophyllum* Nees (1832). *Trichomanes venosum* = *Polyphlebium.*

Ptilophyllum van den Bosch (1861); Prantl (1875) *non aliorum prior.* = *Trichomanes.*

Pachyloma van den Bosch (1861), *non* D. C. (1828). *Hymenophyllum marginatum* = *Craspedophyllum.*

Trigonophyllum Prantl (1875). *Ptilophyllum Bancroftii* = *Trichomanes arbuscula.*

Acarpacrium Prantl (1875). *Ptilophyllum ptilodes* = *Trichomanes alatum.*

Leptomanes Prantl (1875). *Trichomanes tenerum* Spr. = *Vandenboschia.*

Lacosteopsis Prantl (1875). *Trichomanes "radicans* Sw." = *T. rupestre* (?).

Selenodesmium Prantl (1875). *Trichomanes rigidum.*

Holophlebium Christ (1897).

Hemicyatheon Domin (1913). *Hymenophyllum Baileyanum.*

Acanthotheca Nakai (1926), *non* D. C. (1837). *Hymenophyllum acanthoides* = *Meringium.*

Buesia Morton (1932). *Hymenophyllum mirificum.*

Myriodon Copeland (1936). *Hymenophyllum odontophyllum.*

Apteropteris Copeland (1936). *Hymenophyllum malingii.*

Artificial key to the genera of the Hymenophyllaceæ.

Real lamina wanting, and replaced.
- By filaments cells ..... 5. *Apteropteris.*
- By veinless teeth ..... 10. *Myriodon.*

Typical lamina present.
- Involucre valvate.
  - Margin entire and naked.
    - Frond large, simple ..... 14. *Hymenoglossum.*
    - Frond minute, simple..... 2. *Craspedophyllum.*
    - Frond pinnately divided.
      - Accessory wings present ..... 9. *Amphipterum.*
      - Accessory wings absent.
        - Walls thick, coarsely pitted..... 8. *Meringium* spp.
        - Walls not coarsely pitted.
          - Fronds pinnate, axes red-pilose....13. *Serpyllopsis.*
          - Fronds more compound or without red hairs.
            - Base of involucre cyathiform, receptacle exserted..... 3. *Hemicyatheon* (*Baileyanum*).
            - Base of involucre not cyathiform or receptacle included ..... 1. *Mecodium.*
  - Margin hairy.
    - Receptacle included ..... 4. *Sphaerocionium.*
    - Receptacle long-extruded ..... 12. *Leptocionium.*

Margin toothed.
Receptacle long-extruded.
Accessory wings present..... 9. *Amphipterum.*
Accessory wings wanting.
Base of involucre obconic..... 8. *Meringium.*
Base of involucre cyathiform.
3. *Hemicyatheon* (*Deplanchei*).
Receptacle not long-exserted.
Receptacle cylindric or clavate. (Cf. also *Mecodium Reinwardtii* and others.)..... 7. *Hymenophyllum.*
Receptacle subglobose ..... 11. *Buesia.*
Involucre tubular or obconic, not valvate.
Rhizome filiform, fronds remote.
False veinlets present.
Fronds pinnately divided or compound.
False veinlets in the position of veins.
28. *Didymoglossum.*
False veinlets unrelated to veins.... 21. *Crepidomanes.*
Fronds simple or lobed.
With marginal vein ..... 22. *Microgonium.*
Without marginal vein.
Without marginal scales..... 28. *Didymoglossum.*
With marginal scales ..... 29. *Lecanium.*
False veinlets absent.
Fronds marginate.
With hairy axial pads..... 18. *Pleuromanes.*
Naked, without axial pads..... 20. *Crepidopteris.*
Fronds not marginate.
Axes of fronds proliferous..... 19. *Gonocormus.*
Axes not proliferous.
Veins branched within segments.
17. *Polyphlebium.*
Segments one-nerved.
Fronds dichotomous or simple.
6. *Microtrichomanes.*
Fronds pinnate in plan.
Axes coarsely red-pilose.
13. *Serpyllopsis.*
Axes not red-pilose.
16. *Vandenboschia.*
Rhizome stout or fronds clustered.
Cells transversely elongate ..... 33. *Abrodictyum.*
Cells not transversely elongate.
Fronds simple ..... 15. *Cardiomanes.*
Fronds once pinnate.
Oriental ..... 25. *Cephalomanes.*
American.
Fronds not dimorphous ..... 26. *Trichomanes.*
Fronds dimorphous.
Sterile fronds pinnate..... 26. *Trichomanes.*
Sterile fronds pinnatifid..... 27. *Feea.*

Fronds more divided.
Segments stiff and very narrow..... 32. *Macroglena.*
Segments broader or soft.
Rhizome creeping, fronds remote.
Fronds soft in texture. (Cf. also *Trichomanes rupestre* and others.)
16. *Vandenboschia.*
Fronds harsh ..... 30. *Selenodesmium.*
Fronds clustered.
Fronds 1 cell thick.
Walls thick, coarsely pitted.
30. *Selenodesmium.*
Walls not coarsely pitted.
American ..... 26. *Trichomanes.*
Palæotropic.
Stipes bristly.
23. *Callistopteris.*
Stipes not bristly.
24. *Nesopteris.*
Fronds thicker ..... 31. *Davalliopsis.*

1. Genus MECODIUM Presl

Mecodium PRESL, Epim. Bot. (1852 ?) 258, *Nomen.*
Diploophyllum VAN DEN BOSCH, Eerste Bijdrage (1861) 322, *non Diplophyllum* Lehm. (1814).
Hymenophyllum, § *Euhymenophyllum auct. plur., nec rite.*
Hymenophyllum, § *Sphaerocionium part.* C. CHR., Suppl. Tert. (1934).

Analoga Pleuromanis in Hymenophyllaceis existunt plura, nempe . . . inter Hymenophylloidas Mecodium sanguinolentum (Hymenophyllum sanguinolentum Swartz).—PRESL, loc. cit.

Epiphyticae, rhizomate gracile, frondibus remotis, mediocribus vel majoribus, pinnatim decompositis, marginibus integris nudis, parietibus cellularum typice tenuibus, soris pantotactis, involucris aut ad basim aut usque ad laminam frondis bivalvibus, receptaculo incluso.

Type, *M. sanguinolentum* Presl (*Trichomanes sanguinolentum* Forster).

A pantropic and austral genus of about 100 recognized species, the largest genus of the family.

This genus as a whole has remained without a name, first because both Presl and van den Bosch failed to grasp it, leaving it partly or largely in *Hymenophyllum*, and later (beginning with van den Bosch) because it was wrongly construed as *Hymenophyllum* by those who recognized *H. tunbridgense* as foreign to it, and assigned that species to *Leptocionium.*

Presl certainly did not adequately describe his genus *Mecodium*. His description would be inaccurate, even if what he wrote were correct, which it is not. He misconstrued the axial pads of *Pleuromanes;* and there is nothing to justify the statement as to *M. sanguinolentum*, more than as to most species of the family, that it is "analogous" to *Pleuromanes*, as the latter is, still less as he thought it to be. I adopt his generic name because it exists, and its use is preferable to the invention of a new name. The only other generic name proposed for any of these ferns is *Diploophyllum*, invalidated under present rules by *Diplophyllum* Lehm. (1814).

Like *Meringium* and *Vandenboschia*, *Mecodium* includes aberrant species in the far South, vestiges, as I picture the case, of a flora antedating the present evolution of the family, with these genera satisfactorily uniform in the Tropics of both hemispheres. In the Tropics and in the Southern Temperate Zone, with the exceptions just noted, *Mecodium* is one of the most uniform and easily recognized of large genera. Within it are groups common to the two hemispheres—whether because of transoceanic migration or because of separate descent from common Antarctic ancestors, I do not guess. Certainly, however, *M. badium* and *M.*[19] *caudiculatum* are more nearly related to one another than either is to *M. polyanthos*. In both hemispheres, receptacles, elongate or globose or otherwise dilated, with or without sporangiophores, characterize groups of species; but these differences are so gradual, from species to species, that it would be impracticable (as well as, I believe, unnatural) to use them, as Presl attempted, as generic criteria. This seems to me true also of the branching of the bundle at the base of the sorus, to which van den Bosch attached supergeneric significance; it is conspicuous in *M. rarum* and some relatives, and in occasional other plants, including forms of *M. polyanthos* which I do not distinguish specifically.

Laminæ more than one cell in thickness are a far more remarkable peculiarity. I use them to characterize *Davalliopsis* and *Cardiomanes*, but do not recognize a genus *Diploophyllum*, partly for the reason advanced by Mettenius, that besides fronds wholly thick (when mature and on adult plants) there are

[19] These combinations are made in the list of species, immediately following; their use here in anticipation does not constitute publication, and is less awkward than citation under older names.

others in *Mecodium* which are partially so (*M. demissum, M. australe*), so that the distinction is not a sharp one; but more than this, it is because the several species with thick leaves seem independently related to species of the typical family structure, which makes it impossible to combine as a genus the two known species with fronds usually thick throughout.

Included in *Mecodium* are three species, *M. Reinwardtii, M. thuidium,* and *M. samoense,* with toothed margin. This margin is denticulate rather than serrulate, and the teeth do not appeal to the eye as the same as those of *Meringium. M. thuidium* has little fronds crisped in a degree reminiscent of *Meringium acanthoides.* I have invoked intergeneric hybridization to explain some such resemblances, but in this case do not believe that any affinity exists. It may be recalled that a series of *Meringium* species has entire margins.

SPECIES OF MECODIUM

MECODIUM POLYANTHOS (Swartz) Copeland comb. nov.

Trichomanes polyanthos SWARTZ, Prod. Fl. Ind. Occ. (1788) 137.
Hymenophyllum polyanthos Swartz, COPELAND, Hymen. (1937) 97, pls. 46, 47.

Pantropic, with very many synonyms.

MECODIUM KUHNII (C. Christensen) Copeland comb. nov.

Hymenophyllum Kuhnii C. CHRISTENSEN, Index (1905) 363; COPELAND, Hymen. (1937) 106, pl. 48.
Hymenophyllum Meyeri KUHN, *non* Presl.

Tropical Africa.

MECODIUM PANICULIFLORUM (Presl) Copeland comb. nov.

Hymenophyllum paniculiflorum PRESL, Hymen. (1843) 147; COPELAND, Hymen. (1937) 110, pl. 51.

PHILIPPINES; BORNEO; JAVA.

MECODIUM NITIDULOIDES Copeland.

Hymenophyllum nitiduloides COPELAND, Hymen. (1937) 112, pl. 52.

LUZON.

MECODIUM OOIDES (F. v. M. and Baker) Copeland comb. nov.

Hymenophyllum ooides F. v. M. and BAKER, Journ. Bot. 28 (1890) 105; COPELAND, Hymen. (1937) 107.

PAPUA.

MECODIUM SANGUINOLENTUM (Forster) Presl.

NEW ZEALAND.

MECODIUM RECURVUM (Gaud.) Copeland comb. nov.

Hymenophyllum recurvum GAUDICHAUD, Freyc. Voy. Bot. (1827) 376; COPELAND, Hymen. (1937) 108, pl. 49.

HAWAII.

MECODIUM PRODUCTUM (Kunze) Copeland comb. nov.

Hymenophyllum productum KUNZE, Bot. Zeit. 6 (1848) 305; COPELAND, Hymen. (1937) 113, pl. 54.

JAVA; SUMATRA; BORNEO; PHILIPPINES.

MECODIUM TODJAMBUENSE Kjellberg.

CELEBES. Differs from *M. productum* in having a wingless stipe.

MECODIUM ANGULOSUM (Christ) Copeland comb. nov.

Hymenophyllum angulosum CHRIST, Philip. Journ. Sci. § C 5 (1908) 269; COPELAND, Hymen. (1937) 109, pl. 50.

PHILIPPINES.

MECODIUM REINWARDTII (van den Bosch) Copeland comb. nov.

Hymenophyllum Reinwardtii VAN DEN BOSCH, Pl. Jungh. I (1856) 567; Hymen. Javan. 52, pl. 42; COPELAND, Hymen. (1937) 115, pl. 55.

MALAY ISLANDS.

MECODIUM THUIDIUM (Harr.) Copeland comb. nov.

Hymenophyllum thuidium HARRINGTON, Journ. Linn. Soc. Bot. 16 (1877) 25; COPELAND, Hymen. (1937) 116, pl. 56.

PHILIPPINES; NEW GUINEA.

MECODIUM SAMOENSE (Baker) Copeland comb. nov.

Hymenophyllum samoense BAKER, Journ. Bot. 1876) 10; COPELAND, Hymen. (1937) 117, pl. 57.

SAMOA; FIJI; QUEENSLAND.

MECODIUM EMARGINATUM (Swartz) Copeland comb. nov.

Hymenophyllum emarginatum SWARTZ, Schrad. Journ. (1801) 101; Synopsis 148, 377; COPELAND, Hymen. (1937) 118, pl. 58.

MALAY ISLANDS; NEW CALEDONIA.

MECODIUM JAVANICUM (Spr.) Copeland comb. nov.

Hymenophyllum javanicum SPR., Syst. Veg. IV (1827) 132; COPELAND, Hymen. (1937) 120, pl. 59.

Ceylon to New Caledonia and Eastern Australia.

MECODIUM PRODUCTOIDES (J. W. Moore) Copeland comb. nov.

Hymenophyllum productoides J. W. MOORE, Bishop Mus. Bull. 102 (1933) 5.

SOCIETY ISLANDS.

MECODIUM FIMBRIATUM (J. Sm.) Copeland comb. nov.

Hymenophyllum fimbriatum J. SM., Hooker's Journ. Bot. 3 (1841) 418, Species Fil. I (1844) 102, pl. 360; COPELAND, Hymen. (1937) 122, pl. 60.

PHILIPPINES.

MECODIUM RIUKIUENSE (Christ) Copeland comb. nov.

Hymenophyllum riukiuense CHRIST, Ann. Cons. Jard. Bot. Geneve 4 (1900) 208; COPELAND, Hymen. (1937) 123, pl. 61.

LOOCHOO ISLANDS.

MECODIUM CORRUGATUM (Christ) Copeland comb. nov.

Hymenophyllum corrugatum CHRIST, Bull. Boiss. II 3 (1903) 508; COPELAND, Hymen. (1937) 124.

Western China.

MECODIUM FLABELLATUM (La Bill.) Copeland comb. nov.

Hymenophyllum flabellatum LA BILL., Nov. Holl. Pl. 2 (1806) 101, pl. 250, fig. 1; COPELAND, Hymen. (1937) 125, pl. 62.

New Zealand to Queensland and Tahiti.

MECODIUM RUFESCENS (Kirk) Copeland comb. nov.

Hymenophyllum rufescens KIRK, Trans. N. Z. Inst. 11 (1879) 457, pl. 19*A*; COPELAND, Hymen. (1937) 126.

NEW ZEALAND.

MECODIUM LE RATII (Ros.) Copeland comb. nov.

Hymenophyllum Le Ratii ROSENSTOCK, Fedde's Repert. 9 (1910) 71; COPELAND, Hymen. (1937) 127, pl. 63.

NEW CALEDONIA.

MECODIUM RARUM (R. Br.) Copeland comb. nov.

Hymenophyllum rarum R. BROWN, Fl. N. Holl. (1810) 159; COPELAND, Hymen. (1937) 128, pl. 64.

NEW ZEALAND; AUSTRALIA.

MECODIUM INVOLUCRATUM Copeland.

Hymenophyllum involucratum COPELAND, Univ. Calif. Publ. Bot. 12 (1931) 375; Hymen. (1937) 129, pl. 65.

RAROTONGA.

MECODIUM WALLERI (M. and B.) Copeland comb. nov.

Hymenophyllum Walleri MAIDEN and BETCHE, Proc. Linn. Soc. N. S. Wales 35 (1910) 802; COPELAND, Hymen. (1937) 130, pl. 66.

QUEENSLAND.

MECODIUM MNIOIDES (Baker) Copeland comb. nov.

Hymenophyllum mnioides BAKER, Syn. Fil. (1873) 57; COPELAND, Hymen. (1937) 131, pl. 67.

NEW CALEDONIA.

MECODIUM MONTANUM (Kirk) Copeland comb. nov.

Hymenophyllum montanum KIRK, Trans. N. Z. Inst. 10 (1877) 394, pl. 21*B*; COPELAND, Hymen. (1937) 121, pl. 68.

NEW ZEALAND.

MECODIUM INTRICATUM (van den Bosch) Copeland comb. nov.

Hymenophyllum intricatum VAN DEN BOSCH, Ned. Kr. Arch. 53 (1863) 168; COPELAND, Hymen. (1937) 132.

TASMANIA.

MECODIUM FUMARIOIDES (Willdenow) Copeland comb. nov.

Hymenophyllum fumarioides WILLDENOW, Sp. Plant. 5 (1810) 526; COPELAND, Hymen. (1937) 132.

South Africa and East African Islands.

MECODIUM HUMBERTII (C. Christ) Copeland comb. nov.

Hymenophyllum Humbertii C. CHRIST, Arch. Bot. 2 (1928) 209; Dansk Bot. Arkiv. 7 (1932) 10, pl. 2, figs. 6–8; COPELAND, Hymen. (1937) 136.

MADAGASCAR.

MECODIUM VERONICOIDES (C. Chr.) Copeland comb. nov.

Hymenophyllum veronicoides C. CHR., in Bonaparte, Notes Pterid. 12 (1920) 20; Pterid. Madag. 9, pl. 2, figs. 9–12; COPELAND, Hymen. (1937) 135.

MADAGASCAR.

The preceding nine species constitute a well-defined group.

MECODIUM IMBRICATUM (Blume) Copeland comb. nov.

Hymenophyllum imbricatum BLUME, Enum. (1828) 220; COPELAND, Hymen. (1937) 137, pls. 70, 71.

MALAYA; POLYNESIA.

MECODIUM TREUBII (Raciborski) Copeland comb. nov.

Hymenophyllum Treubii RACIBORSKI, Pterid. Buit. (1898) 15; COPELAND, Hymen. (1937) 140, pl. 72.

JAVA; NEW GUINEA; PERAK?

MECODIUM JUNGHUHNII (van den Bosch) Copeland comb. nov.

Hymenophyllum Junghuhnii VAN DEN BOSCH, Pl. Jungh. I (1856) 570, Hymen. Javan. 60, pl. 49; COPELAND, Hymen. (1937) 143, pl. 73.

JAVA; SUMATRA; BORNEO.

MECODIUM LONGIFOLIUM (v. A. v. Rosenburgh) Copeland comb. nov.

Hymenophyllum longifolium VAN A. V. ROSENBURGH, Bull. Jard. Bot. Buit. (16) II (1914) 17; COPELAND, Hymen. (1937) 142, pl. 74.

CELEBES; PAPUA; JAVA?

MECODIUM SALAKENSE (Raciborski) Copeland comb. nov.

Hymenophyllum salakense RACIBORSKI, Pterid. Buit. (1898) 18; COPELAND, Hymen. (1937) 143, pl. 75.

JAVA; SUMATRA; BORNEO?

MECODIUM BADIUM (H. and G.) Copeland comb. nov.

Hymenophyllum badium HOOKER and GREVILLE, Icones Fil. (1828) pl. 76; COPELAND, Hymen. (1937) 144, pl. 76.

India to Formosa and Celebes.

MECODIUM CRISPATUM (Wall.) Copeland comb. nov.

Hymenophyllum crispatum Wallich in HOOKER and GREVILLE, Icones Fil. (1828) pl. 77; COPELAND, Hymen. (1937) 148, pl. 77.

India to the Philippines.

MECODIUM CRISPATO-ALATUM (Hayata) Copeland comb. nov.

Hymenophyllum crispato-alatum HAYATA, Icones pl. Formosa 5 (1915) 256; COPELAND, Hymen. (1937) 149, pl. 79.

FORMOSA.

MECODIUM FLEXILE (Makino) Copeland comb. nov.

Hymenophyllum flexile MAKINO, Bot. Mag. Tokyo 13 (1899) 45; COPELAND, Hymen. (1937) 150, pl. 80.

JAPAN.

MECODIUM OPACUM Copeland.

Hymenophyllum opacum COPELAND, Hymen. (1937) 151, pl. 81.

NEW GUINEA.

The preceding ten species are a natural group, with American relatives.

MECODIUM WRIGHTII (van den Bosch) Copeland comb. nov.

Hymenophyllum Wrightii VAN DEN BOSCH, Synopsis (1859) 51[20]; COPELAND, Hymen. (1937) 152, pl. 82.

JAPAN.

MECODIUM EXSERTUM (Wall.) Copeland comb. nov.

Hymenophyllum exsertum WALLICH in Hooker, Spec. Fil. I (1844) 109, pl. 38*A*; COPELAND, Hymen. (1937) 153, pl. 83.

INDIA; CHINA; SIAM.

[20] The page citation is that of the reprint; to get the pagination in Ned. Kr. Arch. 4, add 340.

MECODIUM FLEXUOSUM (A. Cunn.) Copeland comb. nov.

Hymenophyllum flexuosum A. Cunningham, HOOKER, Comp. Bot. Mag. 2 (1836) 369; COPELAND, Hymen. (1937) 154, pl. 84.

NEW ZEALAND.

MECODIUM PULCHERRIMUM (Colenso) Copeland comb. nov.

Hymenophyllum pulcherrimum COLENSO, Tasm. Journ. Nat. Sci. 2 (1844) 185; COPELAND, Hymen. (1937) 156.

NEW ZEALAND.

MECODIUM VILLOSUM (Colenso) Copeland comb. nov.

Hymenophyllum villosum COLENSO, Tasm. Journ. Nat. Sci. 2 (1844) 185; COPELAND, Hymen. (1937) 157.

NEW ZEALAND.

MECODIUM AUSTRALE (Wildenow) Copeland comb. nov.

Hymenophyllum australe WILDENOW, Spec. Pl. 5 (1810) 527; COPELAND, Hymen. (1937) 158, pl. 85.

TASMANIA; NEW ZEALAND; VICTORIA?

MECODIUM DEMISSUM (Forster) Copeland comb. nov.

Trichomanes demissum FORSTER, Prod. (1786) 85.
Hymenophyllum demissum Swartz, COPELAND, Hymen. (1937) 159, pl. 86.

NEW ZEALAND.

MECODIUM DILATATUM (Forster) Copeland comb. nov.

Trichomanes dilatatum FORSTER, Prod. (1786) 85.
Hymenophyllum dilatatum Swartz, COPELAND, Hymen. (1937) 160, pl. 87.

NEW ZEALAND.

MECODIUM SCABRUM (A. Rich.) Copeland comb. nov.

Hymenophyllum scabrum A. RICHARD, Fl. Nouv. Zel. (1832) 90; COPELAND, Hymen. (1937) 161, pl. 87.

NEW ZEALAND.

MECODIUM CUNEATUM (Kunze) Copeland comb. nov.

Hymenophyllum cuneatum KUNZE, Anal. (1837) 50.

CHILE; JUAN FERNANDEZ. *H. Darwini* (Hooker) v. d. Bosch must belong here.

MECODIUM TRIANAE (Hieron.) Copeland comb. nov.

Hymenophyllum Trianae HIERON., Bot. Jahrb. 34 (1904) 429.

From Bolivia to Colombia.

MECODIUM MULTIFLORUM (Ros.) Copeland comb. nov.

Hymenophyllum multiflorum ROSENSTOCK, Meded. Rijks Herb. Leyden No. 19 (1913) 3.

BOLIVIA.

MECODIUM FERAX (van den Bosch) Copeland comb. nov.

Hymenophyllum ferax VAN DEN BOSCH, Synopsis (1859) 52.

ECUADOR; VENEZUELA.

MECODIUM MICROCARPUM (Desv.) Copeland comb. nov.

Hymenophyllum microcarpum DESVAUX, Prod. (1827) 333.

Tropical America.

MECODIUM MACROTHECUM (Fée) Copeland comb. nov.

Hymenophyllum macrothecum FÉE, 11 Mém. (1866) 115, pl. 31, fig. 2.

WEST INDIES.

MECODIUM MYRIOCARPUM (Hooker) Copeland comb. nov.

Hymenophyllum myriocarpum HOOKER, Sp. Fil. I (1844) 106, pl. 37*D*.

From Bolivia to Mexico.

MECODIUM ANDINUM (van den Bosch) Copeland comb. nov.

Hymenophyllum andinum VAN DEN BOSCH, Synopsis (1859) 57.

ECUADOR.

MECODIUM NIGRICANS (Presl) Copeland comb. nov.

Sphaerocionium nigricans PRESL, Linnæa 18 (1844) 536.

Tropical America.

MECODIUM CONTEXTUM (Ros.) Copeland comb. nov.

Hymenophyllum contextum ROSENSTOCK, Fedde's Repert. 22 (1925) 3.

COSTA RICA.

MECODIUM CONSTRICTUM (Christ) Copeland comb. nov.

Hymenophyllum constrictum CHRIST, Bull. Boiss. II 4 (1904) 939.

COSTA RICA.

MECODIUM PROTRUSUM (Hooker) Copeland comb. nov.

Hymenophyllum protrusum HOOKER, Sp. Fil. I (1844) 104, pl. 37*B*.

CENTRAL AMERICA; BOLIVIA.

MECODIUM COSTARICANUM (van den Bosch) Copeland comb. nov.

Hymenophyllum costaricanum VAN DEN BOSCH, Ned. Kr. Arch. 53 (1866) 161.

From Costa Rica to Bolivia.

MECODIUM SILIQUOSUM (Christ) Copeland comb. nov.

Hymenophyllum siliquosum CHRIST, Bull. Boiss. II 4 (1904) 939.

COSTA RICA.

MECODIUM CONTORTUM (van den Bosch) Copeland comb. nov.

Hymenophyllum contortum VAN DEN BOSCH, Ned. Kr. Arch. 53 (1863) 170.

From Costa Rica to Bolivia.

MECODIUM RENIFORME (Hooker) Copeland comb. nov.

Hymenophyllum reniforme HOOKER, Sp. Fil. I (1844) 110, pl. 38*C*.

PERU; ECUADOR.

MECODIUM DENDRITIS (Ros.) Copeland comb. nov.

Hymenophyllum Dendritis ROSENSTOCK, Fedde's Repert. 6 (1909) 308.

BOLIVIA.

MECODIUM TABLAZIENSE (Christ) Copeland comb. nov.

Hymenophyllum tablaziense CHRIST, Bull. Soc. Bot. Geneve II 1 (1909) 216.

COSTA RICA.

MECODIUM ALFREDII (Ros.) Copeland comb. nov.

Hymenophyllum Alfredii ROSENSTOCK, Fedde's Repert. 22 (1925) 4.

COSTA RICA.

MECODIUM ABRUPTUM (Hooker) Copeland comb. nov.

Hymenophyllum abruptum HOOKER, Sp. Fil. I (1844) 88, pl. 31*B*.

Tropical America.

MECODIUM UNDULATUM (Swartz) Copeland comb. nov.

Trichomanes undulatum SWARTZ, Prod. Fl. Ind. Occ. (1788) 137.

Tropical America.

MECODIUM FENDLERIANUM (Sturm) Copeland comb. nov.

Hymenophyllum fendlerianum STURM, Fl. Bras. I[3] (1859) 291.

Tropical America.

MECODIUM AXILLARE (Swartz) Copeland comb. nov.

Hymenophyllum axillare SWARTZ, Schrad. Journ. (1801) 101.

WEST INDIES; VENEZUELA.

MECODIUM ASPLENIOIDES (Swartz) Copeland comb. nov.

Trichomanes asplenioides SWARTZ, Prod. Fil. Ind. Occ. (1788) 136.

Tropical America.

MECODIUM CAUDICULATUM (Mart.) Copeland comb. nov.

Hymenophyllum caudiculatum MARTIUS, Ic. Cr. Bras. (1834) 102, pl. 67.

Patagonia to Brazil and Peru.

2. Genus CRASPEDOPHYLLUM (Presl) Copeland gen. nov.

Hymenophyllum, § *Craspedophyllum* PRESL, Hymen. (1843) 125.[21]
Pachyloma VAN DEN BOSCH, Eerste Bijdrage (1861) 318, *non* De Candolle.

Frons simplex bilobaque, glabra indusioque marginata. Laciniae integrae. Sorus terminalis sessilis. Indusium bipartitum, integrum. Species novohollandica, mihi solummodo ex icone nota, verosimiliter genus proprium efficiens.—PRESL, loc. cit.

Type, *C. marginatum* (Hooker & Greville) Copeland comb. nov.

CRASPEDOPHYLLUM MARGINATUM (Hooker & Greville) Copeland comb. nov.

Hymenophyllum marginatum HOOKER and GREVILLE, Ic. Fil. (1828) pl. 34; COPELAND, Hymen. (1937) 163, pl. 89.

A monotypic genus, probably related to *Mecodium*, known from New South Wales and Tasmania; well characterized by the black contents of the obliquely placed marginal cells; internal walls wavy-thickened; involucre valvate to the base; receptacle cylindric, included.

3. Genus HEMICYATHEON (Domin) Copeland gen. nov.

Hymenophyllum subgenus *Hemicyatheon* DOMIN, Bibl. Bot. 20 Heft 85 (1913) 20.

Pinnulis (segmentis) ultimis integris vel spinuloso-denticulatis; indusiis infundibuliformibus parte inferiore connatis sed supra profunde (usque ad medium vel duos partes tertias bilabiatis et campanulato patentibus; receptaculo longe exserto.—DOMIN, loc. cit.

Genus et Mecodio et Meringio subsimile, frondibus remotis majusculis tripinnatifidis, parietibus cellularum incrassatis, soris magnis pantotactis, involucris deorsum urceolatis sursum bivalvibus, receptaculo extruso.

Typus, H. Baileyanum Domin, loc. cit., sub Hymenophyllo.

A genus that I recognize as such because it consists of two species, certainly nearly related, of which one would be aber-

[21] As to this work, I cite the original pagination in Abh. Böhm. Ges. Wiss. V 3 (1843); to get the page numbers of the reprint, cited in Christensen's Index, subtract 92.

rant in *Mecodium* but wholly out of place in *Meringium*, the other aberrant in *Meringium* and wholly misplaced in *Mecodium*. They are alike in general aspect, which would not bar them from either large genus. The walls are less, and less regularly, thickened than in typical *Meringium*, so that the walls, and thus the texture, are intermediate, and would be unusual in either *Meringium* or *Mecodium*. The involucre is also intermediate, cleft as in *Meringium* but with less cuneate base; while unusual there, it can be matched in *Mecodium*. The receptacle is meringioid, but slender. I do not consider *Mecodium* and *Meringium* nearly related, but, far enough back, they did have a common ancestry. *Hemicyatheon* may date back that far; or may share the characteristics of the two because of more recent hybridization; or the combination of apparent affinities may be fortuitous.

Range: New Caledonia and Queensland.

SPECIES OF HEMICYATHEON

HEMICYATHEON BAILEYANUM (Domin) Copeland comb. nov.

Hymenophyllum Baileyanum DOMIN, Bibl. Bot. 20 Heft 85 (1913) 20; COPELAND, Hymen. (1937) 75, pl. 36.

QUEENSLAND.

HEMICYATHEON DEPLANCHEI (Mett.) Copeland comb. nov.

Hymenophyllum Deplanchei METTENIUS, Linnæa 35 (1868) 393; COPELAND, Hymen. (1937) 76, pl. 36.

NEW CALEDONIA.

4. Genus SPHAEROCIONIUM Presl

Sphaerocionium PRESL, Hymen. (1843) 125.
Dermatophlebium PRESL, Epim. Bot. (1849) 258.

Costa teres, prominula. Venae pinnatae, alternae, distantes, simplices ramosaeque, steriles venulisque conformibus apice libero desinentes. Sorus in lacinia frondis terminalis, compresso-planus, sessilis. Indusium bifidum, laciniis ovato-orbiculatis obtusis adpressis, demum patentibus. Receptaculum indusio brevius, inferne cylindricum nudum, apice globoso-incrassatum et capsuliferum. Capsulae lenticulares, oblique stipitatae.—PRESL, loc. cit.

Epiphytica, rhizomate repente, radicibus praedito; frondibus remotis, majusculis, pinnatim dissectis, margine costisque (rarius superficie) setis simplicibus vel saepius stellatis obsitis; chromatophoris minutis multis; soris pantotactis, involucro plerumque profunde fisso, receptaculo incluso.

Tropical America, Florida to Chile, with a few scattered Old World species.

A large genus, distinguished from *Mecodium* by its pubescence, and from *Leptocionium* by the included receptacle. There is closer apparent affinity to *Microtrichomanes;* if this be real, the latter may be regarded as a daughter genus.

Presl based his genus essentially on a single character, a receptacle with a comparatively slender sterile base, and a globose sporangium-bearing head. On this basis he included naked species immediately related to several minor groups in *Mecodium.* The fact that it was thus evidently unnatural is probably responsible for the failure of his successors to recognize it at all. Characterized with emphasis on the pubescence, it is a natural genus, typified by *S. hirsutum,* which must be regarded as the type of Presl's genus. Correcting the long abuse of the term *Euhymenophyllum* and applying it properly to a group with toothed margin, Christensen, in the Third Supplement to the Index, has taken up *Sphaerocionium* as the subgeneric name for all species of *Hymenophyllum* with entire margin. As I construe it, it is the group segregated by Prantl [22] as "Sect. 4. Pilosa." In the Synopsis of van den Bosch this is the group of *Hymenophyllum* with "Frons vestita," species 97–133.

The hairs in a majority of the species are restricted to the axes and margins. When they have long basal cells at the top of which they branch, they cover the surface with a dense felt, even though none originate there. Marginal hairs are regularly placed, as shown by Prantl. The cell from which one springs may or may not be differentiated evidently. Its differentiation may involve the adjacent cells, the hair then being borne on a projection of the margin, a tooth. In a few cases such teeth have been confused with those of *Meringium,* but they are not homologous. Even when the teeth of *Meringium* are prolonged into short hairs, these are rows of cells, and not bristlelike, as are all the simple hairs of *Sphaerocionium.* Stellate hairs usually branch from the end of a stalk cell, but in a few species the stalk cell is wanting and they branch from the base. Throughout the genus the ultimate branches and the simple setæ are alike in being nonseptate (above the base or basal cell), and sharp and stiff. There is no sharp line between branched hairs, hairs stellate from the base, paired setæ, and simple, solitary setæ. In a few species they are mixed. Sometimes the hairs on the rachis are mostly branched, those on the margin mostly simple,

[22] Hymen. 55.

and on some species (as *S. valvatum*) an occasional hair is forked or branched. A branched hair may have a single branch, having a septum, and usually being bent, at the distal end of the stalk cell.

It should be possible to break so large a genus into natural groups, but I do not know these plants intimately enough to do this with any confidence to the genus as a whole. It is not evident that the character of the receptacle can be used in this way, although I include here species with slender receptacles. The involucre, typically cleft nearly to the base, but sometimes with an evident immersed tube, seems likewise to lack significance. It is only as short lips and an elongate involucre are found together, and branched hairs disappear, in a group of apparently related species, reduced and dichotomous rather than pinnate in architecture, that these characters become evidently diagnostic for a group. And then, because the verbal definition of *Sphaerocionium* (in distinction to hairy plants of *Trichomanes*) would become very different otherwise, I feel constrained to recognize a smaller, related genus, *Microtrichomanes*. Generic status (as *Apteropteris*) is given also to one single species hitherto called *Trichomanes*, and *Hymenophyllum Malingii*, because it is isolated among all ferns by vegetative peculiarity; its hairs are those of *Sphaerocionium*.

SPECIES OF SPHAEROCIONIUM

With secondary lamellæ present on the axes (*Dermatophlebium*):

SPHAEROCIONIUM SERICEUM (Sw.) Presl.

Cuba to Bolivia and Brazil.

SPHAEROCIONIUM TOMENTOSUM (Kunze) Presl.

ANDES.

SPHAEROCIONIUM PLUMOSUM (Kaulf.) Copeland comb. nov.

Hymenophyllum plumosum KAULFUSS, Enum. (1824) 267.
Sphaerocionium aureum PRESL.

BRAZIL; COSTA RICA.

SPHAEROCIONUM PYRAMIDATUM (Desv.) Copeland comb. nov.

Hymenophyllum pyramidatum DESVAUX, Prod. (1827) 332.

ANDES.

H. fusugasugense Karsten, Colombia, belongs here. Without secondary lamellæ.

With branched hairs on axes, margin, and surface:

SPHAEROCIONIUM HIRSUTUM (Sw.) Presl.

The type of the genus; Cuba and Mexico to Chile.

SPHAEROCIONIUM RADDIANUM (K. Müller) Copeland comb. nov.

Hymenophyllum raddianum K. MÜLLER, Bot. Zeit. 12 (1854) 723.

BRAZIL.

SPHAEROCIONIUM INTERRUPTUM (Kze.) Presl.

Tropical America.

SPHAEROCIONIUM LANATUM (Fée) Copeland comb. nov.

Hymenophyllum lanatum FÉE, 11 Mém. (1866) 116, pl. 31, fig. 3.

WEST INDIES.

SPHAEROCIONIUM RUFUM (Fée) Copeland comb. nov.

Hymenophyllum rufum FÉE, Crypt. Vasc. Brazil 1 (1869) 198, pl. 70, fig. 4.

BRAZIL.

SPHAEROCIONIUM SPECTABILE (Mett.) Copeland comb. nov.

Hymenophyllum spectabile METTENIUS ex KUHN, Linnæa 35 (1868) 392.

BOLIVIA.

SPHAEROCIONIUM BUCHTIENII (Ros.) Copeland comb. nov.

Hymenophyllum Buchtienii ROSENSTOCK, Fedde's Repert. 5 (1908) 229.

BOLIVIA.

SPHAEROCIONIUM HEMIPTERON (Ros.) Copeland comb. nov.

Hymenophyllum hemipteron ROSENSTOCK, Fedde's Repert. 22 (1925) 4.

COSTA RICA.

SPHAEROCIONIUM PALMENSE (Ros.) Copeland comb. nov.

Hymenophyllum palmense ROSENSTOCK, Fedde's Repert. 22 (1925) 5.

COSTA RICA.

SPHAEROCIONIUM WERCKLEI (Christ) Copeland comb. nov.

Hymenophyllum Wercklei CHRIST, Bull. Boiss. II 4 (1904) 940.

COSTA RICA.

SPHAEROCIONIUM HYGROMETRICUM (Poiret) Copeland comb. nov.

Trichomanes hygrometricum POIRET, Enc. 8 (1808) 79.
Sphaerocionium elasticum (Bory) PRESL.

East African Islands.

SPHAEROCIONIUM SPLENDIDUM (v. d. B.) Copeland comb. nov.

Hymenophyllum splendidum VAN DEN BOSCH, Ned. Kr. Arch 5 [3] (1863) 192; COPELAND, Hymen. (1937) 174.

WEST AFRICA.

Here seem to belong also:

With branched hairs on axes and margin; surface naked:

HYMENOPHYLLUM AERUGINOSUM (Poiret) Carm.

TRISTAN D'ACUNHA.

HYMENOPHYLLUM LINDENI Hooker.

VENEZUELA; ECUADOR.

SPHAEROCIONIUM CILIATUM (Sw.) Presl.

Tropical America to East African Islands.

SPHAEROCIONIUM LINEARE (Sw.) Presl.

WEST INDIES.

SPHAEROCIONIUM CRUEGERI (K. Müller) Copeland comb. nov.

Hymenophyllum Cruegeri K. MÜLLER, Bot. Zeit. (1854) 722.

West Indies to Brazil.

SPHAEROCIONIUM ANTILLENSE (Jenman) Copeland comb. nov.

Hymenophyllum antillense JENMAN, Bull. Dept. Jam. No. 18 (1890) 6.

JAMAICA; HISPANIOLA.

SPHAEROCIONIUM ELEGANS (Spr.) Copeland comb. nov.

Hymenophyllum elegans SPR., Syst. Veg. IV (1827) 133.

BRAZIL; COSTA RICA.

SPHAEROCIONIUM HIRTELLUM (Sw.) Presl.

WEST INDIES; MEXICO; CENTRAL AMERICA.

SPHAEROCIONIUM DIVERSILOBUM Presl.

HISPANIOLA.

HYMENOPHYLLUM TRAPEZOIDALE Liebm.

MEXICO. This and the preceding species may be merely freaks.

SPHAEROCIONIUM ELEGANTULUM (v. d. B.) Copeland comb. nov.

Hymenophyllum elegantulum VAN DEN BOSCH, Synopsis 68.
Hymenophyllum pulchellum HOOKER, Sp. Fil. I, pl. 33*A*.

Colombia to Bolivia.

SPHAEROCIONIUM RUIZIANUM Kl.

VENEZUELA; PERU.

SPHAEROCIONIUM TRICHOPHYLLUM (H. B. K.) Copeland comb. nov.

Hymenophyllum trichophyllum H. B. K., Nov. Gen. et Sp. I (1815) 27.

BRAZIL; ANDES.

SPHAEROCIONIUM SAMPAIOANUM (Brade et Ros.) Copeland comb. nov.

Hymenophyllum Sampaioanum BRADE et ROSENSTOCK, Bol. Mus. Rio de Janeiro 1 (1931) 136, pl. 1, fig. 2; pl. 3; *Hymenophyllum Sampaii* in herb.

BRAZIL.

Here seem to belong:

HYMENOPHYLLUM ADIANTOIDES van den Bosch.

PERU.

HYMENOPHYLLUM CRISPATULUM van den Bosch.

PERU.

HYMENOPHYLLUM SPRUCEI Baker.

PERU.

SPHAEROCIONIUM FERRUGINEUM (Colla) Copeland comb. nov.

Hymenophyllum ferrugineum COLLA, Mem. Ac. Torino 39 (1836) 30.
Hymenophyllum subtilissimum Kze.

Chile to New Zealand.

SPHAEROCIONIUM LANCEOLATUM (Hooker and Arnott) Copeland comb. nov.

Hymenophyllum lanceolatum HOOKER and ARNOTT, Bot. Beechey's Voy. (1832) 109.

HAWAII.

SPHAEROCIONIUM OBTUSUM (Hooker and Arnott) Copeland comb. nov.

Hymenophyllum obtusum HOOKER and ARNOTT, Bot. Beechey's Voy. (1832) 109.

HAWAII.

SPHAEROCIONIUM LYALLII (Hooker) Copeland comb. nov.

Hymenophyllum Lyallii HOOKER f., Fl. N. Zealand II (1854) 16.
Trichomanes Lyallii HOOKER, Syn. Fil. (1867) 77; COPELAND, Trich. (1933) 163, pl. 7, fig. 7; pl. 11, fig. 4.

NEW ZEALAND; NEW SOUTH WALES.

SPHAEROCIONIUM PILOSISSIMUM (C. Chr.) Copeland comb. nov.

Hymenophyllum pilosissimum C. CHR., Gardens' Bull. S. S. 7 (1934) 213.

BORNEO; PHILIPPINES; NEW GUINEA.

SPHAEROCIONIUM MARLOTHII (Brause) Copeland comb. nov.

Hymenophyllum Marlothii BRAUSE, Fedde's Repert. 11 (1912) 122.

SOUTH AFRICA.

SPHAEROCIONIUM CAPILLARE (Desv.) Copeland comb. nov.

Hymenophyllum capillare DESVAUX, Prod. (1827) 333.
Sphaerocionium pendulum (Bory) Presl.

Africa and Islands.

SPHAEROCIONIUM POOLII (Baker) Copeland comb. nov.

Hymenophyllum Poolii BAKER, Journ. Linn. Soc. 15 (1876) 413; Icones Pl. 1609.

MADAGASCAR.

With unbranched setæ:

SPHAEROCIONIUM VALVATUM (H. and G.) Copeland comb. nov.

Hymenophyllum valvatum HOOKER and GREVILLE, Icones Fil. (1831) pl. 219.

West Indies to Bolivia.

SPHAEROCIONUM ELEGANTISSIMUM (Fée) Copeland comb. nov.

Hymenophyllum elegantissimum FÉE, 11 Mém. (1866) 118, pl. 29, fig. 2.

WEST INDIES.

SPHAEROCIONIUM MICROCARPUM (Desv.) Copeland comb. nov.

Hymenophyllum microcarpum DESVAUX, Prod. (1827) 33.

Tropical America.

SPHAEROCIONIUM DURANDII (Christ) Copeland comb. nov.

Hymenophyllum Durandii CHRIST, Bull. Boiss. 4 (1896) 657.

COSTA RICA.

SPHAEROCIONIUM SUBRIGIDUM (Christ) Copeland comb. nov.

Hymenophyllum subrigidum CHRIST, Bull. Boiss. II 5 (1905) 260.

COSTA RICA.

SPHAEROCIONIUM SEMIGLABRUM (Res.) Copeland comb. nov.

Hymenophyllum semiglabrum ROSENSTOCK, Fedde's Repert. 9 (1910) 67.

COSTA RICA.

Here seems to belong:

HYMENOPHYLLUM FRANCAVILLEI van den Bosch.

WEST INDIES.

SPHAEROCIONIUM SUBOBTUSUM (Ros.) Copeland comb. nov.

Hymenophyllum subobtusum ROSENSTOCK, Fedde's Repert. 9 (1910–1911) 71; COPELAND, Hymen. (1937) 173.

NEW CALEDONIA.

5. Genus APTEROPTERIS Copeland gen. nov.

Hymenophyllum subgen. *Apteropteris* COPELAND, Hymen. (1937) 176.

Lamina vera omnino carente, filamentis brevibus celluarum axibus frondis ubique excurrentibus pilis stellatis dense obtectis substituta, segmentis frondis deinde crasse filiformibus haud applanatis.—COPELAND, loc. cit.

Species unica: *Apteropteris Malingii* (Hooker) Copeland.

APTEROPTERIS MALINGII (Hooker) Copeland comb. nov.

Trichomanes Malingii HOOKER, Garden Ferns (1862) pl. 64.

Hymenophyllum Malingii METTENIUS, Hymen. 423, pl. 1, fig. 32; GIESENHAGEN, Flora (1890) 442, pl. 4, fig. 25; COPELAND, Hymen. (1937) 176.

Epiphytic, in New Zealand, usually on *Libocedrus Bidwillii*, in Tasmania on *Athrotaxis selaginoides*. The illustrations of Mettenius and Giesenhagen show the structure perfectly. The best description is by Holloway,[23] who calls it "certainly the most peculiar species of the New Zealand family both in its frond structure and in its distribution."

The stellate hairs are unmistakable evidence of affinity to *Sphaerocionium*.

6. Genus MICROTRICHOMANES (Mettenius) Copeland gen. nov.

Trichomanes, Gruppe *Micro-trichomanes* METTENIUS, Hymen. (1864) 413.

Gonocormus, § *Microtrichomanes* PRANTL, Hymen. 51.

Folia disticha . . ., dichotome v. subpinnatim partita, . . . striis nulis . . . Folium non proliferum, margine saepe ciliatum; indusii tubus latetudinem limbi vix superans; paleae rectae.—PRANTL, loc. cit.

Typice epiphytica, rhizomate filiforme late repente et intricato, radicibus praedito; frondibus parvis, repetiter dichotomis rarissime simplicibus, rhache vera ita carente, costis ubique alatis, margine aut minute setiferis aut nudis; parietibus cellularum tenuibus; soris in apices segmentorum immersis, involucro obconico vel campanulato, non bilabiato, receptaculo gracile modo exserto, sporangiis majusculis.

Typus, M. digitatum (Swartz sub Trichomane).

A small genus of the Old World Tropics, related to *Sphaerocionium* and probably derived from it.

Range: Malaya to Tahiti and Madagascar.

Dealing with a group presumably derived, by reduction, from ferns with more amply developed fronds, it must be observed, as in other such cases, that reduction is likely to result in convergent evolution, whereby species of diverse ancestry have be-

[23] Trans. N. Z. Inst. 54 (1923) 596, pls. 66, 76.

come similar. I may be misled in this manner into including in *Microtrichomanes* some species which do not belong here. So far as marginal setæ are present, they present sufficient evidence of affinity to *Sphaerocionium;* and the gap between *S. Lyallii* and *M. palmatifidum* is too narrow to leave reasonable doubt on the subject. They would be treated as congeneric, if the considerable number of species to which they are related in opposite directions did not make convenient an intergeneric boundary between them. As to the species without setæ, they seem to be related to those which bear setæ; but setæ are structures not usually lost in the course of reduction of the fronds.

The relation of *Microtrichomanes* and the still more reduced genera, *Didymoglossum* and *Microgonium,* invites study. Between *Microtrichomanes* and *Gonocormus,* which are united by Prantl, there is no near affinity.

SPECIES OF MICROTRICHOMANES

MICROTRICHOMANES PALMATIFIDUM (K. Müll.) Copeland comb. nov.

Trichomanes palmatifidum K. MÜLLER, Bot. Zeit. 12 (1854) 732; VAN DEN BOSCH, Hymen. Javan. 20, pl. 14; COPELAND, Trich. (1933) 162, pl. 7, fig. 6; pl. 11, fig. 1.

JAVA; SUMATRA; BORNEO; MALAY PENINSULA.

MICROTRICHOMANES RIDLEYI Copeland.

Trichomanes Ridleyi COPELAND, Trich. (1933) 162, pl. 11, figs. 2, 3.

PAHANG.

MICROTRICHOMANES DIGITATUM (Sw.) Copeland comb. nov.

Trichomanes digitatum SWARTZ, Syn. Fil. (1806) 370; COPELAND, Trich. (1933) 159, pl. 7, figs. 3, 4.

East African Islands; Malaya to Samoa? Christensen[24] would restrict this name to the form found in Madagascar and the Seychelles, recognizing *T. flabellatum* v. d. Bosch, described from Java, as distinct. Three Philippine forms might be distinguished, but probably blend. The following two species are still more aberrant.

MICROTRICHOMANES DICHOTOMUM (Kze.) Copeland comb. nov.

Trichomanes dichotomum KUNZE, Bot. Zeit. 6 (1848) 285; VAN DEN BOSCH, Hymen. Javan. 22, pl. 16; COPELAND, Trich. (1933) 160, pl. 7, fig. 5.

JAVA.

[24] Pterid. Madag., p. 3.

MICROTRICHOMANES TÆNIATUM Copeland.

Trichomanes tæniatum COPELAND, Bishop Mus. Bull. 93 (1932) 6, pl. 2; Trich. (1933) 161, pl. 10.

SOCIETY ISLANDS; SOLOMON ISLANDS.

MICROTRICHOMANES NITIDULUM (v. d. B.) Copeland comb. nov.

Trichomanes nitidulum VAN DEN BOSCH, Pl. Jungh. (1856) 547; Hymen. Javan. 21, pl. 15; COPELAND, Trich. (1933) 155, pl. 7, fig. 1.

JAVA; SUMATRA; CEYLON; TONKIN; NEW SOUTH WALES. This and the species to follow are without setæ.

MICROTRICHOMANES PARVULUM (Poiret) Copeland comb. nov.

Trichomanes parvulum POIRET, Lam., Enc. 8 (1808) 64, not of most subsequent authors nor Copeland, Trich. (1933) 145.
Trichomanes sibthorpioides Bory, COPELAND, Trich. (1933) 154, pl. 8.
Hymenophyllum sibthorpioides Mettenius, C. CHRISTENSEN, Pterid. Madag. 11, pl. 2, figs. 15–18.

East African Islands. The evidence suggested several times by Christensen, and summarized in Pterid. Madag., p. 3, seems to leave little doubt that the original *T. parvulum* is the species later described by Bory as *T. sibthorpioides*, removed to *Hymenophyllum* by Mettenius, and equally out of place there.

MICROTRICHOMANES FRANCII (Christ) Copeland comb. nov.

Trichomanes Francii CHRIST, Bull. Boissier II 7 (1907) 648; COPELAND, Trich. (1933) 156, pl. 7, fig. 2.

NEW CALEDONIA.

MICROTRICHOMANES VITIENSE (Baker) Copeland comb. nov.

Trichomanes vitiense BAKER, Journ. Linn. Soc. Bot. 9 (1866) 338, pl. 8, fig. 2; DOMIN, Bibl. Bot. 20: 10, pl. 3, fig. 3; COPELAND, Trich. (1933) 157, pl. 9, figs. 1, 2.

FIJI; SAMOA; QUEENSLAND. The fronds are forked, or reduced to simple.

7. Genus HYMENOPHYLLUM Smith

Hymenophyllum SMITH, Mém. Acad. Turin 5 (1793) 418.

Sorus marginalis receptaculo cylindraceo insertus. Indusium bivalve sorum includens.—SMITH, loc. cit.

Genus cosmopolitanum filicum terrestrium et epiphyticarum, rhizomate repente, frondibus mediocribus vel parvis pinnatim dissectis, marginibus serrulatis nudis, involucris profunde bivalvibus, receptaculo cylindrico interdum supra basin leviter incrassato, aut incluso aut involucro tantum longiore, sporangiis magnis sessilibus.

Type, *H. tunbridgense* (L.) Smith.

A genus of perhaps 25 very similar species, notable for their occurrence in temperate lands, though not wanting in the Tropics. Its near affinity is to *Meringium*, from which it is distinguished by the more deeply cleft involucre, the shorter receptacle, the absence of peculiarly (pitted) thickened cell walls, and usually smaller size. There are species in the far South, perhaps primitive, which share the characteristics of the two genera; and there are very reduced species there and elsewhere which, in the course of reduction, have lost their clear generic criteria. However, *Meringium* in its full development is so different that it seems clearly expedient to maintain both genera.

SPECIES OF HYMENOPHYLLUM

HYMENOPHYLLUM TUNBRIDGENSE (L.) Smith.

Scotland to Italy; Atlantic Islands, South Africa; South America.

HYMENOPHYLLUM BARBATUM Baker.

Japan to India.

HYMENOPHYLLUM SIMONSIANUM Hooker.

India to Formosa.

HYMENOPHYLLUM CUPRESSIFORME Lab.

AUSTRALIA.

HYMENOPHYLLUM GRACILESCENS Domin.

AUSTRALIA.

HYMENOPHYLLUM REVOLUTUM Colenso.

NEW ZEALAND.

HYMENOPHYLLUM RUGOSUM C. Christ & Skottsberg.

JUAN FERNANDEZ.

HYMENOPHYLLUM FALKIANDICUM Baker.

ANTARCTIC AMERICA.

HYMENOPHYLLUM PELTATUM Desv.

All southern lands, to Norway.

HYMENOPHYLLUM ANTARCTICUM Presl.

AUSTRALIA.

HYMENOPHYLLUM AFFINE Brack.

FIJI.

HYMENOPHYLLUM PERFISSUM Copeland.

BORNEO.

HYMENOPHYLLUM ASPERULUM Kunze.

ANDES.

HYMENOPHYLLUM HERZOGII Ros.

BOLIVIA.

Dwarfs which may be reduced representatives of either *Hymenophyllum* or *Meringium* are *H. pumilum* Moore, *H. Pumilio* Ros., and *H. minimum* Rich.

H. Levingei Clarke, of the Himalayas, described as bearing both hairs and paleæ, is otherwise in this genus, but is not to be placed with confidence until so remarkable a peculiarity is verified.

H. pectinatum Cav., Antarctic America, belongs in this rather than in any other genus, but is an isolated species, like so many others of the far South.

8. Genus MERINGIUM Presl

Meringium PRESL, Hymen. (1843) 116, pl. 8*B*.

Typice epiphyticae, frondibus remotis mediocribus pinnatim decompositis, marginibus serrulatis vel rarius integris, parietibus cellularum saepe valde incrassatis et grosse vittatis, soris paratactis, involucris deorsum obconicis sursum bivalvibus, receptaculo praelongo gracile, sporangiis sessilibus magnis.

Type, *Meringium meyenianum* Presl.

A genus of 60 or more recognized species, of the Tropics and South Temperate Zone, best developed in the Malay region, with several American species, and but one known in Africa; distinguished from *Hymenophyllum* by the closed lower part of the involucre and the long-exserted receptacle; also, in general, by larger and coarser fronds, with thick and coarsely pitted walls—like those of *Selenodesmium*. From India to Polynesia it is a common and homogeneous group. The New Zealand species are less distinct from *Hymenophyllum* in the development of the walls.

Presl overlooked the affinity to *Hymenophyllum*, compared his type with *Didymoglossum*, and with the group of *Trichomanes rigidum*, and described and pictured the sorus as "basi bibracteatus." As nobody has since seen the bracts, his plant was long unrecognized and supposed to be some *Trichomanes;* while the group it typifies came to be known by the name of another of his genera, really distinct, *Leptocionium*. He also gave generic

names, *Myrmecostylum* and *Ptychophyllum*, to two other South Chilean plants, certainly related to *Meringium*, which I include in the latter. I believe, though, that since migration from a common home farther south the evolution of the American and Oriental groups has been independent.

There is a group of ill-defined species, ranging from Madagascar to the Philippines, which, with some loss of stature, have more or less completely lost the marginal teeth. *M. macroglossum* and *M. pachydermicum* seem always to be entire. *M. edentulum* is almost so. *M. holochilum* is serrulate, with sparse teeth. Although these entire species have been assigned to most diverse groups—several of them even to *Trichomanes*—there is no question whatever as to their affinity. They complicate a complete diagnosis of *Meringium*, but it is impracticable to separate them from it.

SPECIES OF MERINGIUM

MERINGIUM MEYENIANUM Presl.

Hymenophyllum meyenianum COPELAND, Hymen. (1937) 25, pl. 8.

PHILIPPINES; NEW GUINEA.

MERINGIUM BAKERI Copeland.

Hymenophyllum Bakeri COPELAND, Sarawak Mus. Journ. 2 (1917) 309; Hymen. (1937) 29.

Southern Philippines to Sumatra.

MERINGIUM KLABATENSE (Christ) Copeland comb. nov.

Hymenophyllum klabatense CHRIST, Verh. Nat. Ges. Basel 11 (1894) 4; COPELAND, Hymen. (1937) 30.

CELEBES; MINDANAO.

MERINGIUM VITTATUM Copeland.

Hymenophyllum vittatum COPELAND, Hymen. (1937) 31, pl. 9, figs. 1–3.

LUZON.

MERINGIUM BICOLANUM Copeland.

Hymenophyllum bicolanum COPELAND, Hymen. (1937) 31, pl. 10.

LUZON.

MERINGIUM CAMPANULATUM (Christ) Copeland comb. nov.

Hymenophyllum campanulatum CHRIST, Philip. Journ. Sci. § C 2 (1907) 155; COPELAND, Hymen. (1937) 32, pl. 11.

NEGROS (Philippines).

MERINGIUM BONTOCENSE Copeland.

Hymenophyllum bontocense COPELAND, Hymen. (1937) 33, pl. 12.

LUZON.

MERINGIUM MERRILLII (Christ) Copeland comb. nov.

Hymenophyllum Merrillii CHRIST, Philip. Journ. Sci. § C 2 (1907) 154; COPELAND, Hymen. (1937) 33, pl. 13.

LUZON.

MERINGIUM RAMOSII Copeland.

Hymenophyllum Ramosii COPELAND, Hymen. (1937) 34, pl. 9, figs. 4–6.

MINDANAO.

MERINGIUM HOLOCHILUM (v. d. B.) Copeland comb. nov.

Didymoglossum holochilum VAN DEN BOSCH, Pl. Jungh. I (1856) 561.
Hymenophyllum holochilum C. Chr., COPELAND, Hymen. (1937) 34, pl. 14.

Java to Papua and Malay Peninsula.

Apparent relatives of *M. holochilum* are *Hymenophyllum rufifolium* v. A. v. Rosenburgh, *H. rufifrons* v. A. v. R., *H. Elberti* Rosenstock, *H. brevidens* v. A. v. R., *H. torricellianum* v. A. v. R., *H. ellipticosorum* v. A. v. R., *H. nutantifolium* v. A. v. R., *H. pedicularifolium* Cesati, and *H. cincinnatum* Gepp.

MERINGIUM EDENTULUM (v. d. B.) Copeland comb. nov.

Leptocionium edentulum VAN DEN BOSCH, Ned. Kr. Arch. 53 (1868) 148.
Hymenophyllum edentulum C. Christ, COPELAND, Hymen. (1937) 24, pl. 7.

ASSAM; LUZON; BORNEO.

MERINGIUM PACHYDERMICUM (Cesati) Copeland comb. nov.

Hymenophyllum pachydermicum CESATI, Atti. Accad. Napoli 8 (1876) 8; COPELAND, Hymen. (1937) 20, pl. 5.

Philippines to Sumatra.

MERINGIUM PENANGIANUM (M. and C.) Copeland comb. nov.

Hymenophyllum penangianum MATTHEW and CHRIST, Journ. Linn. Soc. Bot. 39 (1909) 214; COPELAND, Hymen. (1937) 19, pl. 4.

BORNEO; MALAY PENINSULA.

MERINGIUM MACROGLOSSUM (v. d. B.) Copeland comb. nov.

Hymenophyllum macroglossum VAN DEN BOSCH, Ned. Kr. Arch. 5[2] (1863) 156; COPELAND, Hymen. (1937) 19, pl. 3.

CEYLON.

MERINGIUM TENELLUM (Jacq.) Copeland comb. nov.

Adiantum tenellum JACQ., Coll. Bot. III (1789) 287, pl. 21, fig. 3.
Hymenophyllum ricciaefolium Bory, COPELAND, Hymen. (1937) 17, pl. 1.

East African Islands.

MERINGIUM POLLENIANUM (Ros.) Copeland comb. nov.

Hymenophyllum pollenianum ROSENSTOCK, Meded. Rijks Herb. Leyden No. 11 (1912) 1; COPELAND, Hymen. (1937) 18, pl. 2.

MADAGASCAR.

MERINGIUM PULCHRUM Copeland.

Hymenophyllum pulchrum COPELAND, Hymen. (1937) 22, pl. 6.

Southern Philippines.

Apparently in the same group as the preceding seven species, with margins entire or nearly so, are *H. batuense* Ros., Batu Island, and *H. Hallieri* Ros., Borneo.

MERINGIUM BRACHYGLOSSUM (A. Br.) Copeland comb. nov.

Hymenophyllum brachyglossum A. BR., Bot. Zeit. 5 (1847) 227; COPELAND, Hymen. (1937) 40.

JAVA.

MERINGIUM DENTICULATUM (Sw.) Copeland comb. nov.

Hymenophyllum denticulatum SWARTZ, Schrad. Journ. (1801) 100, Synopsis (1806) 148, 375; COPELAND, Hymen. (1937) 41, pl. 15.

Ceylon to Fiji.

MERINGIUM HOSEI Copeland.

Hymenophyllum Hosei COPELAND, Philip. Journ. Sci. § C 12 (1917) 46; Hymen. (1937) 45, pl. 16.

BORNEO.

This transfer precludes that of the same specific name for the earlier *Trichomanes Hosei* which is *Meringium penangianum;* the purpose being to avoid a new specific name for *H. Hosei.*

MERINGIUM ACANTHOIDES (v. d. B.) Copeland comb. nov.

Didymoglossum acanthoides VAN DEN BOSCH, Pl. Jungh. I (1856) 16.
Hymenophyllum acanthoides Rosenstock, COPELAND, Hymen. (1937) 45, pl. 17.

Java to Luzon; FORMOSA; NEW GUINEA.

MERINGIUM CARDUNCULUS (C. Chr.) Copeland comb. nov.

*Hymenophyllum Carduncul*us C. CHRISTENSEN, Mitt. Inst. Bot. Hamburg 7 (1928) 144; COPELAND, Hymen. (1937) 47.

BORNEO.

MERINGIUM KERIANUM (Watts) Copeland comb. nov.

Hymenophyllum kerianum WATTS, Proc. Linn. Soc. N. S. Wales **39** (1915) 767; COPELAND, Hymen. (1937) 48.

QUEENSLAND.

MERINGIUM MACROSORUM (v. A. v. R.) Copeland comb. nov.

Hymenophyllum macrosorum v. A. v. ROSENBURGH, Bull. Jard. Bot. Buit. **16** (1914) 18; COPELAND, Hymen. (1937) 48.

SUMATRA.

MERINGIUM LOBBII (Moore) Copeland comb. nov.

Hymenophyllum Lobbii MOORE in van den Bosch, Ned. Kr. Arch. **5**[2] (1863) 176; COPELAND, Hymen. (1937) 49.

BORNEO.

MERINGIUM BLANDUM (Racib.) Copeland comb. nov.

Hymenophyllum blandum RACIBORSKI, Pterid. Buit. (1898) 20; COPELAND, Hymen. (1937) 50, pl. 18.

Java to Luzon.

MERINGIUM REDUCTUM Copeland.

Hymenophyllum reductum COPELAND, Hymen. (1937) 53, pl. 20.

PHILIPPINES.

MERINGIUM ROSENSTOCKII (Brause) Copeland comb. nov.

Hymenophyllum Rosenstockii BRAUSE, Bot. Jahrb. **56** (1920) 43; COPELAND, Hymen. (1937) 53, pl. 21, figs. 1, 2.

NEW GUINEA.

Hymenophyllum Hertericanum Brause may belong here; I have not seen the sorus.

MERINGIUM DIMIDIATUM (Mett.) Copeland comb. nov.

Hymenophyllum dimidiatum METTENIUS, Linnæa **35** (1868) 393; COPELAND, Hymen. (1937) 54.

NEW CALEDONIA.

MERINGIUM OVATUM Copeland.

Hymenophyllum ovatum COPELAND, Philip. Journ. Sci. § C **6** (1911) 70; Hymen. (1937) 56, pl. 22.

PAPUA.

MERINGIUM RUBELLUM (Ros.) Copeland comb. nov.

Hymenophyllum rubellum ROSENSTOCK, Nova Guinea **8** (1912) 716; COPELAND, Hymen. (1937) 56.

NEW GUINEA.

MERINGIUM FIRMUM (v. A. v. R.) Copeland comb. nov.

Hymenophyllum firmum v. A. v. ROSENBURGH, Nova Guinea **14** (1924) 28; COPELAND, Hymen. (1937) 57.

NEW GUINEA.

MERINGIUM GORGONEUM Copeland.

Hymenophyllum gorgoneum COPELAND, Hymen. (1937) 60, pl. 26.

SOLOMON ISLANDS.

MERINGIUM MACGILLIVRAYI (Baker) Copeland comb. nov.

Trichomanes Macgillivrayi BAKER, Ann. Bot. **5** (1891) 195.
Hymenophyllum Macgillivrayi COPELAND, Hymen. (1937) 60, pl. 25.

FIJI.

MERINGIUM FEEJEENSE (Brack.) Copeland comb. nov.

Hymenophyllum feejeense BRACKENRIDGE, U. S. Expl. Exped. **16** (1854) 266, pl. 37; COPELAND, Hymen. (1937) 61, pl. 27.

FIJI.

MERINGIUM PRAETERVISUM (Christ) Copeland comb. nov.

Hymenophyllum praetervisum CHRIST, Bot. Jahrb. **23** (1896) 338; COPELAND, Hymen. (1937) 62, pl. 28.

SAMOA.

Hymenophyllum minimum Richard, *H. pumilum* Moore, and *H. pumilio* Ros., are exceedingly reduced species, which may belong here.

MERINGIUM MULTIFIDUM (Forster) Copeland comb. nov.

Trichomanes multifidum FORSTER, Prod. (1786) 85.
Hymenophyllum multifidum Swartz, COPELAND, Hymen. (1937) 65, pl. 30, figs. 1–3.

NEW ZEALAND.

MERINGIUM BIVALVE (Forster) Copeland comb. nov.

Trichomanes bivalve FORSTER, Prod. (1786) 84.
Hymenophyllum bivalve Swartz, COPELAND, Hymen. (1937) 66, pl. 30, figs. 4–6.

New Zealand to Queensland.

The preceding two species have the sori and aspect of *Meringium*, and are therefore included in it; but the structure is rather that of *Hymenophyllum*. They may represent an evolutionary stage prior to the typical differentiation of the two genera.

MERINGIUM TRIANGULARE (Baker) Copeland comb. nov.

Hymenophyllum triangulare BAKER, Syn. Fil. (1873) 69; COPELAND, Hymen. (1937) 67.

AFRICA.

MERINGIUM TORTUOSUM (H. and G.) Copeland comb. nov.

Hymenophyllum tortuosum HOOKER and GREVILLE, Icones Fil. (1829) pl. 129.

Myrmecostylum tortuosum PRESL, Hymen. 119, pl. 10*A*.

ANTARCTIC AMERICA.

MERINGIUM PLICATUM (Kaulf.) Copeland comb. nov.

Hymenophyllum plicatum KAULFUSS, Enum. (1824) 268.

Ptychophyllum plicatum PRESL, Hymen. 120, pl. 11*E*.

ANTARCTIC AMERICA.

The two preceding species are the types of Presl's cited genera. To me they seem to be very typical *Meringium*, conforming in wall structure, margin, and involucre, and, so far as my poor fruiting material shows, in receptacle. The more or less overfull and therefore ruffled or crisped lamina of *M. plicatum* is no novelty in the genus. Presl described and figured one valve of the involucre as cleft to the base. I have seen such a monstrosity, very rarely, in Philippine species, and do not find it in the material in hand of *M. plicatum*.

H. quadrifidum Philippi is described as having a 4-valved involucre. If this is a fixed character, not a remarkable abnormality, the subject will best be regarded, as he suggested, as constituting a genus *Tetralasma*. I have now (May, 1938), by the kindness of Mr. Gualterio Looser, a photograph of part of the original collection of this plant, and am sure that the quadrifid involucre is not a constant peculiarity. The species appears to be *M. magellanicum*.

MERINGIUM MAGELLANICUM (Desv.) Copeland comb. nov.

Didymoglossum magellanicum DESVAUX, Prod. (1827) 331.

ANTARCTIC AMERICA, southern Brazil. Typical *Meringium*, throughout its range.

MERINGIUM SECUNDUM (H. and G.) Copeland comb. nov.

Hymenophyllum secundum HOOKER and GREVILLE, Icones Fil. (1829) Pl. 133.

ANTARCTIC AMERICA. The internal walls are somewhat reticulate-thickened.

MERINGIUM FUCOIDES (Sw.) Copeland comb. nov.

Trichomanes fucoides SWARTZ, Prod. Fl. Ind. Occ. (1788) 136.

Tropical America. Internal walls feebly reticulate-thickened.

H. dentatum Cav., southern Chile, has the margin and involucre of *Meringium*, but is otherwise too distinct for easy inclusion. Neither does it go naturally into any other genus. In

its sharing of the characteristics of the modern genera it impresses me as more generalized than *M. multifidum*, in that it seems related to *Mecodium*, which is not in general by any means as close to *Meringium* as is *Hymenophyllum*.

9. Genus AMPHIPTERUM Presl

Amphipterum PRESL, Epim. Bot. (1852) 258.

Altior evolutionis gradus est ille, si raches costaque venaeque ala foliacea libera bilaterali serrata in pagina superiori frondis instructae sunt.—Talem organisationem exhibet inter Trichomanoideas Amphipterum fuscum (Trichomanes fuscum Blume, . . .—PRESL, loc. cit.

Genus Meringio derivatum, venis aut inferne aut utraque facie alis vel cristis accessoriis praeditis distinguendum; margine aut serrulata aut integra; soris magnis segmenta axillaria abbreviata tertiaria (vel sursum secondaria) terminantibus, involucro vix ad mediam longitudinem bilabiato, deorsum cristato vel laminato, receptaculo valde extruso.

As in the case of some other genera for which I use Presl's names, he left them really *nomina nuda*, except as the citation of a species serves perfectly for their identification. In the case of *Amphipterum*, in contrast to *Mecodium*, what little he wrote to characterize it is approximately correct. The accessory wings are the sole distinction from *Meringium*. There are several species of *Sphaerocionium* with similar structures, and they probably constitute a natural group; I do not set this group up as a genus, because such a genus would shade into *Sphaerocionium*, and its recognition would not facilitate the definition or recognition of the parent genus. *Amphipterum* is clear-cut; that is, there is no known species with incipient or occasional accessory wings. And its recognition facilitates that of *Meringium*, because two of its species have entire margins. It is true that species with entire margin remain in *Meringium;* these are not near relatives of *Amphipterum*, and cannot be set off generically because they intergrade in this respect with the parent.

Four species are known to me, ranging from Sumatra to Papua.

SPECIES OF AMPHIPTERUM

AMPHIPTERUM FUSCUM (Blume) Presl.

Trichomanes fuscum BLUME.

Hymenophyllum fuscum VAN DEN BOSCH, Hymen. Javan. 62 pl. 51, 52*B;* COPELAND, Hymen. (1937) 69, pl. 31.

JAVA; SUMATRA.

AMPHIPTERUM LEDERMANNI (Brause) Copeland comb. nov.

Hymenophyllum Ledermanni BRAUSE, Bot. Jahrb. 50 (1920) 41; COPELAND, Hymen. (1937) 70, pl. 32.

NEW GUINEA. *H. cernuum* Gepp may provide the correct specific name of this species.

AMPHIPTERUM GELUENSE (Ros.) Copeland comb. nov.

Hymenophyllum geluense ROSENSTOCK, Fedde's Repert. 5 (1908) 372; COPELAND, Hymen. (1937) 72, pl. 33.

NEW GUINEA.

AMPHIPTERUM LAMINATUM Copeland.

Hymenophyllum laminatum COPELAND, Philip. Journ. Sci. § C 6 (1911) 70; Hymen. (1937) 73, pl. 34.

PAPUA.

10. Genus MYRIODON Copeland gen. nov.

Hymenophyllum subgenus *Myriodon*, COPELAND, Hymen. (1937) 73.

Lamina normale continua omnino carente, dentibus longitudinalibus ad rhachin costasque ubique et irregulariter affixis substituta, involucro medio fisso ubique dentifero, receptaculo extruso.—COPELAND, loc. cit.

Type, *M. odontophyllum* Copeland.

A genus of a single known species, derived from *Meringium* and more particularly related to *M. denticulatum*. The frond looks so like the exceedingly crisped one of *M. acanthoides* that Brause described this as a variety of that species. But less superficial examination shows that instead of a crisped lamina it has no continuous lamina whatever, no particle of green tissue containing a vein, being thus almost unique among ferns. Its assimilating tissue consists of aphlebiate teeth, as that of *Apteropteris*, consists of filaments.

SPECIES OF MYRIODON

MYRIODON ODONTOPHYLLUM Copeland.

Hymenophyllum odontophyllum COPELAND, Hymen. (1937) 73, pl. 35.

NEW GUINEA.

11. Genus BUESIA (Morton) Copeland gen. nov.

Hymenophyllum subgenus *Buesia* MORTON, Bot. Gaz. 93 (1932) 336.

Filix pendula, rhizomatibus longe repentibus; stipites et rhaches paleis pluri-cellularibus basi cellulis 2- vel 3-seriatis planis instructi; rhaches primariae secundariaeque flexuosissimae; laminae elongatae pinnatae, pinnis tripinnatipartitis; segmenta ultima serrata; sori in lobulis intimis contractis abbreviatis dispositi; indusium bifidum margine undulatum; receptaculum subglobosum crassum.

Species typica: *Hymenophyllum mirificum* Morton.—MORTON, loc. cit.

Genus Meringio affine, alis axium majorum in paleas dissolutis, margine serrulato, soris paratactis involucris profunde bivalvibus, receptaculo breve crasso.

I follow Morton's suggestion and treat this as a genus, although it is not very distinct from *Meringium* as here, perhaps too broadly, construed. The same palealike structures occur on *Meringium plicatum*, are reported on *Hymenophyllum Levingii*, and completely replace the usual lamina of *Myriodon*.

SPECIES OF BUESIA

BUESIA MIRIFICA (Morton) Copeland comb. nov.

Hymenophyllum mirificum MORTON, Bot. Gaz. 93 (1932) 336, fig. 1.

PERU.

BUESIA SODIROI (C. Christ) Copeland comb. nov. Plate 2.

Hymenophyllum Sodiroi C. CHRIST, Index (1905) 368; *H. pendulum* (SODIRO non Bory).

ECUADOR.

Buesia Sodiroi is a stouter and less finely dissected species with huge sori. I conclude from Morton's description of *H. mirificum* that besides the paleæ in the natural position of fragments of the wing, they are found scattered (sparsim), but on the frond given me by the National Herbarium they seem all to originate in the plane of the lamina. This is true of most of them on *B. Sodiroi*, but a few are unmistakably inserted out of this plane; which is less startling because they are inserted in all planes on the axes of *Myriodon*. Having seen these structures on *B. Sodiroi*, I can interpret the description and figure of another species, not seen, and confidently call it:

BUESIA JAMESONI (Hooker) Copeland comb. nov.

Hymenophyllum Jamesoni HOOKER, Spec. Fil. I (1844) 96, pl. 35*A*.

ECUADOR. Except that the fertile segments are not constricted below them, the sori are exactly those of *B. Sodiroi*.

12. Genus LEPTOCIONIUM Presl

Leptocionium PRESL, Hymen. (1843) 118, 11 *D*.

Venae pinnatae, simplices, prominulae, libere desinentes. Sorus terminalis, sessilis. Indusium usque fere ad basim bipartitum suborbiculatum, laciniis planis appressis margine aequaliter serrato-ciliatis. Receptaculum cylindricum, obtusum, undique capsuliferum, junius indusio aequilongum, adultum duplo longius nudum cicatriculis oblongis spiralibus notatum. Capsulae lenticulares, sessiles.

Genus inter Trichomanoideas et Hymenophylloideas intermedium, priorum receptaculum, posteriorum indusium possidens.—PRESL, loc. cit.

A single species, *L. dicranotrichum* Presl, of southern Chile. (Plate 3.)

Actually, the margin is entire, as Presl drew it. Margin and surface bear many very short setæ, which are mostly geminate. *Leptocionium* has the sorus of *Meringium*, and the margin and setæ of *Sphaerocionium*, the setæ short and simple, commonly pinnate.

Not knowing or appreciating Presl's *Meringium*, which has page priority, van den Bosch adopted Presl's name *Leptocionium* for all Hymenophyllaceæ with toothed margins, and the use of the name in this sense, as a subgenus, has been usual since his time, but is corrected in the third Supplement to Christensen's Index.

13. Genus SERPYLLOPSIS van den Bosch

Serpyllopsis VAN DEN BOSCH (Synopsis p. 37, nomen), Versl. Akad. Wetens. Amsterdam 11 (1861) 318.

Frons pinnata, pinnae simplices integrae vena simplici percursae, sori laterales, receptaculum incrassatum teres.—VAN DEN BOSCH, loc. cit.

Christensen amplified the generic description, emphasizing: "1) the indefinite growth of the leaves, and 2) the pubescence of thick red hairs along the rachis and midribs of pinnæ beneath."[25]

The type species, and the only species named as in the genus, is *S. caespitosa* (Gaud.) C. Chr.[26] (Plate 4), *S. antarctica* v. d. Bosch.

Range: Antarctic America, Falkland Islands, Juan Fernandez. Christensen[27] recognized three varieties, besides the typical form. Of these, two have specific names in *Hymenophyllum: H. densifolium* Philippi, with deeply bilabiate involucre with obscurely dentate lips; and *H. Dusenii* Christ, the involucre with entire, truncate mouth, but with few and spatulate pinnæ and evident, filiform stipe. The typical form has subsessile fronds and pinnæ with broadly rounded bases, and the involucre very shallowly bilabiate with dentate lips. Christensen and Skottsberg[28] described still another variety, *fernandeziana*, with deeply immersed and broadly winged involucres cleft halfway down, and dentate lips crested on the back.

[25] Arkiv. f. Bot. 10[2] (1910) 28.
[26] Archiv f. Bot. 10[2] (1910) 29.
[27] Loc. cit.
[28] Pterid. of Juan Fernandez (1920) 5.

Aside from the fructification, there is a strong but perhaps superficial resemblance to *Hymenophyllum rarum*, and the far southern occurrence of both makes their affinity a reasonable conjecture. Even if this were established, it would remain expedient to maintain *Serpyllopsis* as a genus, whether with one or with three or more known species.

14. Genus HYMENOGLOSSUM Presl

Hymenoglosum PRESL, Hymenophyllaceae (1843) 127.

Costa utrinque teres, prominula flexuosa. Venae oppositae, subopposita alternaeque, angulo acuto exorientes, parallelae, utrinque prominulae, simplicissimae, in dentes frondis marginatae excurrentes, ante marginem obtuse desinentes. Sori in dentibus frandis apicales.

Rhizoma repens, filiforme . . . Frondes glaberrimae.

Species. Hymenoglossum cruentum (Hymenophyllum cruentum Cav.). —PRESL, loc. cit.

Range: Chile, Juan Fernandez.

The genus was retained by van den Bosch [29] and by Christensen and Skottsberg,[30] was unknown to Prantl, and is included in *Hymenophyllum* by other authors, including Christensen. In that genus it is isolated by characters of form and structure. As to form, the fronds are simple and large, about 10 cm long and broadly lanceolate; no other species in the family resembles it. The veins are simple, remote, parallel. The margin varies from subentire (sterile) to obtusely serrate, with a sorus at the end of each tooth, half-immersed and cleft halfway down, the lips entire, receptacle included. Anatomical characters are a broad marginal band two cells thick, and a thickened line around each parenchyma cell next to the outside wall.[31] (Plate 5.)

There is no evident particular affinity to any other species or group.

15. Genus CARDIOMANES Presl

Cardiomanes PRESL, Hymen. (1843) 104.

Costa nulla. Venae pedato-flabellatae, crebrae, furcatae, steriles ante marginem frondis apice obtuso desinentes. Sorus intramarginalis, immersus. Indusium campanulatum, ore integrum. Capsulae lenticulares, receptaculo clavato obtuso demum exserto undique affixae.—PRESL, loc. cit.

Terrestre, rhizomate valido, late repente; stipitibus remotis, erectis; fronde simplice, reniforme, majuscula, coriacea, stratis

[29] Synopsis 45, Bijdrage.

[30] Pteridophyta of Juan Fernandez. Nat. Hist. Juan Fernandez 2 (1920) 6.

[31] Mettenius, Hymen. (1864) pl. 2, fig. 33.

ca. IV cellularum composita, venis flabellato-dichotomis; soris marginalibus, involucris cylindricis immersis, receptaculo exserto.

A single species (Plate 6), perhaps the most isolated in the family, endemic in New Zealand.

CARDIOMANES RENIFORME (Forster) Presl.

16. Genus VANDENBOSCHIA Copeland gen. nov.

Trichomanes auctorum omnium, partim.
Trichomanes, § *Eutrichomanes* PRESL, VAN DEN BOSCH, PRANTL, *partim.*

Typice epiphyticae, rhizomate elongato scandente, frondibus remotis, pinnatim dissectis; parietibus cellularum tenuibus, ubique conformibus; soris pantotactis, involucris infundibuliformibus ore non bilabiatis, receptaculis gracilibus protrusis, sporangiis parvis. Species typica: V. radicans (Swartz sub Trichomane).

Range: That of the family.

This is the most nearly cosmopolitan genus in the family. Among those which have been included in *Trichomanes*, it is the least differentiated; on this ground I regard it as most nearly primitive. A considerable number of the genera of more limited geographic range are evidently derived from it. Thus, *Cephalomanes* in the Orient can be derived approximately from the Oriental *V. auriculata;* while *Trichomanes*, an American genus, is traced back approximately through the American *T. rupestre* to *Vandenboschia;* the two lines of distinct origin being superficially so parallel in evolution that Prantl combined parts of them in one small genus, *Lacostea*. Other probable derivatives of *Vandenboschia* are the pantropic *Selenodesmium* (prior to dispersal from the Antarctic), the American *Davalliopsis* and *Didymoglossum*, and the Oriental *Crepidopteris, Crepidomanes, Callistopteris, Nesopteris*, and *Pleuromanes*.

The failure of this very well-known group to bear any distinctive and valid name is explained under *Trichomanes*, as due to the misapplication of that name to this group.

SPECIES OF VANDENBOSCHIA

VANDENBOSCHIA PHILIPPIANA (Sturm) Copeland comb. nov.

Trichomanes Philippianum STURM, Enum. Pl. r. vasc. Chil. (1858) 38; VAN DEN BOSCH, Goddijn, Meded. Rijk's Herb. Leyden No. 17 (1913) 24, fig. 13; CHRISTENSEN and SKOTTSBERG, Pterid. Juan Fernandez (1920) 2, fig. 1.

JUAN FERNANDEZ.

This is the most generalized species of the old genus *Trichomanes*. The fronds are either remote or clustered, and our limited material indicates the absence of sharp distinction between rhizome and stipe. This strongly suggests *Gonocormus*, to which van den Bosch, as far as I can see, did not refer it. (His number, 8*a*,[32] places it with *T. dichotomum*, a *Microtrichomanes*.) The involucre is variable in form, but sufficiently like that of *V. pyxidifera*. The very large cells suggest *Macroglena*. The stipellate walls of the marginal cells, and sometimes the submarginal, are altogether peculiar. This species may constitute a genus; but I prefer to let the most generalized number of the group stand at the bottom of the least specialized, and in that sense most primitive, genus.

VANDENBOSCHIA INGAE (C. Chr.) Copeland comb. nov.

Trichomanes Ingae C. CHR., Christensen and Skottsberg, Pterid. Juan Fernandez (1920) 3, fig. 2.

JUAN FERNANDEZ.

Here probably belongs *T. pyxidiferum* var. *marchionicum* E. Brown.

VANDENBOSCHIA COLENSOI (Hooker) Copeland comb. nov.

Trichomanes Colensoi HOOKER, f. Icones Pl. 10 (1854) 979; HOLLOWAY, Trans. N. Z. Inst. 54 (1923) pl. 73; COPELAND, Trich. (1933) 137, pl. 3.

NEW ZEALAND.

VANDENBOSCHIA FALLAX (Christ) Copeland comb. nov.

Trichomanes fallax CHRIST, Ann. Mus. Congo V 3 (1909) 24; CHRISTENSEN, Dansk Bot. Arkiv. 7 (1932) 5, pl. 1, figs. 1, 2.

WEST AFRICA; MADAGASCAR.

VANDENBOSCHIA DRAYTONIANA (Brack.) Copeland comb. nov.

Trichomanes draytonianum BRACKENRIDGE, U. S. Expl. Exped. 16 (1854) 252, pl. 36, fig. 3; COPELAND, Trich. (1933) 134, pl. 1, figs. 4–7.

HAWAII.

Trichomanes Wildii Bailey seems to belong here.

VANDENBOSCHIA STENOSIPHON (Christ) Copeland comb. nov.

Trichomanes stenosiphon CHRIST, Fedde's Repert. 5 (1898) 10; COPELAND, Trich. (1933) 133, pl. 1, fig. 2.

KOREA.

[32] Ned. Kr. Arch. 5 [2] (1861) 141.

VANDENBOSCHIA PARVA Copeland.

Trichomanes parvum COPELAND, Trich. (1933) 134, pl. 1, fig. 3.

FORMOSA.

VANDENBOSCHIA SCHMIDIANA (Zenker) Copeland comb. nov.

Trichomanes Schmidianum ZENKER, Taschner, Dissert. (1843) 34, pl. 1, figs. 1, 3, 5; COPELAND, Trich. (1933) 135, pl. 2, fig. 1.

INDIA.

VANDENBOSCHIA PYXIDIFERA (Linn.) Copeland comb. nov.

Trichomanes pyxidiferum LINNÆUS, Sp. Pl. (1753) 1098; SLOSSON, Bull. Torrey Bot. Club 42 (1915) 651.

American Tropics; tropical (?) and South Africa.

I cannot distinguish *T. brasiliense* Desv. from this species. Several other related "species" are unknown to me.

VANDENBOSCHIA HYMENOPHYLLOIDES (v. d. B.) Copeland comb. nov.

Trichomanes hymenophylloides VAN DEN BOSCH, Ned. Kruid. Arch. 5[2] (1863) 209; SLOSSON, loc. cit.

Tropical America.

T. borbonicum van den Bosch, of the East African Islands is, *teste* Christensen, very nearly this species.

VANDENBOSCHIA DIAPHANA (H. B. K.) Copeland comb. nov.

Trichomanes diaphanum H. B. K., Nov. Gen. et Sp. I (1825) 25.

Tropical South America.

VANDENBOSCHIA HERZOGII (Ros.) Copeland comb. nov.

Trichomanes Herzogii ROSENSTOCK, Meded. Rijks Herb. Leyden No. 19 (1913) 5.

BOLIVIA.

VANDENBOSCHIA SERRATIFOLIA (Ros.) Copeland comb. nov.

Trichomanes serratifolium ROSENSTOCK, Hedw. 46 (1906) 77.

BRAZIL.

VANDENBOSCHIA TENERA (Spr.) Copeland comb. nov.

Trichomanes tenerum SPR., Syst. Veg. IV (1827) 129.

Mexico to Uruguay.

VANDENBOSCHIA CAPILLACEA (Linn.) Copeland comb. nov.

Trichomanes capillaceum LINNÆUS, Sp. Pl. (1753) 1099.

Tropical America.

This and the preceding species are Prantl's section *Leptomanes*. *T. angustatum* Carm., of Tristan d'Acunha, unknown to me, may belong here, may be *Macroglena*, or may be neither.

VANDENBOSCHIA EXSECTA (Kze.) Copeland comb. nov.

Trichomanes exsectum KUNZE, Anal. (1837) 47, pl. 29, fig. 2.

SOUTHERN CHILE; JUAN FERNANDEZ.

Like so many far-southern species this is rather isolated in character. Both the lamina and the tube of the involucre are peculiarly marginate.

VANDENBOSCHIA RADICANS (Sw.) Copeland comb. nov.

Trichomanes radicans SWARTZ, Schrad. Journ. (1801) 97, Synopsis 143; COPELAND, Trich. (1933) 213, pl. 35, figs. 1, 2.

Tropical America and West Africa, north to Kentucky, Britain, India, and Japan, wanting or nearly so in Malaya and in Polynesia. In my treatise on *Trichomanes* I have reduced to this many supposed Oriental species. Many described American species have been treated in the same way by others. *T. speciosum* Willd., of the Canaries, is a local form probably worthy of specific recognition.

VANDENBOSCHIA SCANDENS (Linn.) Copeland comb. nov.

Trichomanes scandens LINNÆUS, Sp. Pl. (1753) 1098.

WEST INDIES.

TRICHOMANES GIGANTEUM Bory.

Bourbon; perhaps local here and in Madagascar; but the name has been given to specimens from Sumatra to Fiji.

VANDENBOSCHIA APHLEBIOIDES (Christ) Copeland comb. nov.

Trichomanes aphlebioides CHRIST, C. Chr., Index (1906) 635; HOLTTUM, Journ. Mal. Br. Roy. As. Soc. 6 (1928) 18, pl. 4; COPELAND, Trich. (1933) 219, pl. 38, figs. 5–8.

Sumatra to Fiji.

VANDENBOSCHIA MAXIMA (Blume) Copeland comb. nov.

Trichomanes maximum BLUME, Enum. (1828) 228; VAN DEN BOSCH, Hymen. Javan. 25, pl. 18; COPELAND, Trich. (1933) 217, pl. 38, figs. 1–4.

Malaya to Tahiti.

VANDENBOSCHIA JOHNSTONENSIS (Bailey) Copeland comb. nov.

Trichomanes johnstonense BAILEY, Proc. Royal Soc. Queensland 1 (1884) 14, lithograms, pl. 26.

QUEENSLAND; PHILIPPINES.

VANDENBOSCHIA DAVALLIOIDES (Gaud.) Copeland comb. nov.

Trichomanes davallioides GAUDICHAUD, Freycinet, Voy. Bot. (1826) 378; COPELAND, Trich. (1933) 215, pl. 36.

HAWAII.

VANDENBOSCHIA CYRTOTHECA (Hillеb.) Copeland comb. nov.

Trichomanes cyrtotheca HILLEBRAND, Fl. Haw. (1888) 636; COPELAND, Trich. (1933) 216, pl. 35, figs. 3, 4; pl. 37.

HAWAII.

VANDENBOSCHIA AURICULATA (Blume) Copeland comb. nov.

Trichomanes auriculatum BLUME, Enum. (1828) 225; COPELAND, Trich. (1933) 223.

Cephalomanes auriculatum VAN DEN BOSCH, Hymen. Javan. 34, pl. 25.

Malaya to Japan and Papua.

17. Genus POLYPHLEBIUM Copeland nom. nov.

Phlebiophyllum VAN DEN BOSCH, Versl. Akad. Wet. Amsterdam 11 (1861) 321, *non Phlebophyllum* Nees (1832).

Epiphyticum, rhizomate scandente intricato filiforme; frondibus remotis, pendentibus, mediocribus, pinnatifidis vel pinnatis, pinnis plerisque linearibus, rarius lanceolatis pinnatifidisque, membranaceis, costis pinnatim ramosis venulis dichotomis; soris axillaribus, involucro elongato-urceolato, ore expanso, receptaculo gracile longissimo.

An isolated, monotypic genus; the only plant in the family with very thin leaves in which the veins branch freely in undivided segments of the frond. What affinity it has is presumably to the group of *V. pyxidifera.*

Range: New Zealand to Tasmania and Queensland.

SPECIES OF POLYPHLEBIUM

POLYPHLEBIUM VENOSUM (R. Br.) Copeland comb. nov. Plate 7.

Trichomanes venosum R. BROWN, Prod. Fl. N. Holland (1810) 159; COPELAND, Trich. (1933) 138.

18. Genus PLEUROMANES Presl

Pleuromanes PRESL, Epim. Bot. (1849) 258.

Leucomanes PRESL, ibid.

Craspedoneuron VAN DEN BOSCH, Synopsis (1859) 21, as section; Hymen. Javan. (1861) 12, as genus.

Typice epiphytica, rhizomate filiforme late repente et intricato, molliter piloso; stipitibus remotis gracillimis; frondibus pendentibus glaucis, majusculis, bi-tripinnatifidis, segmentis linearibus margine incrassato, strato sclerenchymatico costam circumdante dilatato, parte mediale segmenti ideo crassa et opaca, molliter pilosa; soris axillaribus, involucris urceolatis ore aut truncato aut subexpanso, receptaculo filiforme valde protruso.

A small, well-marked genus, derived from *Vandenboschia latifrons,* a relative of *V. pyxidifera.* In my paper on Trichomanes

I treated *T. latifrons* as a member of the daughter group; but, as a matter of convenient verbal definition, it is necessary to leave it in the parent genus. As to the margin, cf. Copeland, Hymen. (1937) pl. 10, and Mettenius, pl. 1, fig. 23.

Range: Ceylon and Luzon to Tahiti. *V. latifrons* is found from the Himalayas to Formosa and Luzon.

SPECIES OF PLEUROMANES

PLEUROMANES ACUTUM Presl.

Trichomanes acutum PRESL, Hymen. 134; COPELAND, Trich. (1933) 140.

LUZON. The type species.

PLEUROMANES PALLIDUM (Blume) Presl.

Trichomanes pallidum BLUME, Enum. 225; COPELAND, Trich. (1933) 141.

The range of the genus.

19. Genus GONOCORMUS van den Bosch

Gonocormus VAN DEN BOSCH, Hymen. Javan. (1861) 7; Eerste Bijdrage (1861) 321.

Rhizomate et stipite vix vel tantum distinguendis, tenuibus, obscuris, rigidis, apice stipitis typice prolifera; frondibus minutis, venatione flabellata, margine inciso, parietibus non vittatis; involucris immersis tubiformi-campanulatis ore conspicue dilatatis, receptaculo exserto.

A well-defined genus of exceedingly ill-defined species, ranging from Africa across Polynesia and to Japan.

The first publication of the generic name was not accompanied by a diagnosis, but it is authenticated by described species of which the first is *G. minutus* (*Trichomanes minutum* Bl.). A diagnosis was published in the same year. I have discussed this group in sufficient detail in my treatise on Trichomanes.[33] The Marquesan specimen, *Mumford and Adamson 361*, which [34] I regarded as *T. parvulum*, is *T. latilabiatum* E. Brown.[35] Christensen [36] believes that *T. parvulum* Poir. is really the plant since called *T.* (or *Hymenophyllum*) *sibthorpioides*, and suggests that the widespread species of *Gonocormus* would better be called *T.*

[33] 142 ff.
[34] This issue, p. 106.
[35] Bishop Mus. Bull. 89 (1931) 8, fig. 3.
[36] Pterid. Madagascar (1932) 3.

saxifragoides Presl. An older name is *T. minutum* Blume, from which I do not consider *T. saxifragoides* genetically distinct.

If species are to be distinguished in *Gonocormus*, they may be:

G. minutus (Blume) v. d. Bosch, using this name for what has been called *T. parvulum;* the range of the genus.

G. diffusus (Blume) v. d. Bosch.

G. prolifer (Blume) Prantl, exemplifying the genus in its most characteristic development.

G. Teysmanni v. d. Bosch.

GONOCORMUS ALAGENSIS (Christ) Copeland comb. nov.

Trichomanes alagense CHRIST, Philip. Journ. Sci. § C 3 (1908) 270; COPELAND, Trich. (1933) 152, pl. 6, figs. 4–7.

PHILIPPINES. More distinct than are most of these species.

GONOCORMUS LATILABIATUS (E. Brown) Copeland comb. nov.

Trichomanes latilabiatum E. BROWN, Bishop Mus. Bull. No. 89 (1931) 8, fig. 3.

MARQUESAS.

20. Genus CREPIDOPTERIS Copeland nom. nov.

Trichomanes, § *Crepidium* PRESL, Hymen. (1843) 115, *non Crepidium* Blume (1825).

Crepidomanes VAN DEN BOSCH, Hymen. Javan. (1861) 16, *non* Presl.

Aut epiphyticae aut terrestres, rhizomate gracile late repente, frondibus remotis minusculis, typice bipinnatifidis, rhachi alata, venulis spuriis nullis; cellulis marginalibus 1- vel 2-seriatis valde elongatis parietibus varie incrassatis, cellulis aliis isodiametricis parietibus tenuibus; soris segmenta acropetalia infima occupantibus, involucris infundibuliformibus alatis ore patente, receptaculo protruso.

Typus: C. humilis (Forster sub Trichomane).

A small, well-defined genus of the Malay-Polynesian region, regarded as a relative of the group of *Vandenboschia pyxidifera* for want of other evident affinity; probably not nearly related to *Crepidomanes* with which it has been confused. The longitudinally elongate marginal cells are a convenient diagnostic characteristic, but the genus is recognizable at sight by a combination of characters—small size, thinness, narrowly elliptic form, degree of dissection, position of sori—which are not individually diagnostic. If two rows of cells are elongate, the inner row may be double in thickness (two cells deep).

SPECIES OF CREPIDOPTERIS

CREPIDOPTERIS HUMILIS (Forster) Copeland comb. nov.

Trichomanes humile FORSTER, Prod. (1786) 12; COPELAND, Trich. (1933) 164, pl. 12.

Sumatra to Tahiti, not to New Zealand.

CREPIDOPTERIS CRACILLIMA Copeland.

Trichomanes gracillimum COPELAND, Trich. (1933) 168, pl. 13.

LUZON.

CREPIDOPTERIS ENDLICHERIANA (Presl) Copeland comb. nov.

Trichomanes endlicherianum PRESL, Epim. Bot. (1849–51) 10, pl. 5*A*; COPELAND, Trich. (1933) 168, pls. 14, 15.

New Zealand to Norfolk, Fiji, and Tahiti.

CREPIDOPTERIS WERNERI (Rosenst.) Copeland comb. nov.

Trichomanes Werneri ROSENSTOCK, Fedde's Repert. 5 (1908) 35; COPELAND, Trich. (1933) 170, pl. 16.

NEW GUINEA.

CREPIDOPTERIS VIEILLARDII (v. d. B.) Copeland comb. nov.

Trichomanes Vieillardii VAN DEN BOSCH, Ann. Sc. Nat. IV 15 (1861) 90; COPELAND, Trich. (1933) 171, pl. 17.

NEW CALEDONIA.

21. Genus CREPIDOMANES Presl

Crepidomanes PRESL, Epim. Bot. (1851) 258.
Taschneria PRESL, ibid.; COPELAND (as group), Trich. (1933) 174.

Cellulae parenchymatis magnae, seriales, rotundato-hexagonoideae, lateribus crassiusculis. Venae venulaeque distantes, simplices, costis conformes. Venula inframarginalis tenuis, continua. Reliqua ut in Eutrichomane.—PRESL, loc. cit. (etiam p. 17).

Epiphytica rarius terrestria, rhizomate filiforme late repente, piloso, radicibus saepe vel semper carentibus; frondibus mediocribus pinnatim dissectis (vel reductis digitatis), axibus plerisque alatis, segmentis angustis monophlebiis, margine integro nudo, striis sclerenchymaticis aut intramarginalibus aut irregulariter dispersis nunquam carentibus; soris typice axillaribus (paratactis), involucro obconico, vel campanulato, vel infundibuliforme, alato, ore bifido (rarissime symmetrice evoluto), receptaculo exserto.

An Old World genus of a dozen or more species ranging from the East African Islands to Japan and Polynesia. The striæ

afford a convenient and sure diagnostic character, and the mouth of the involucre is bilabiate with the single exception of *C. Christii.* This combination of characters has been regarded as sufficient to establish affinity to *Didymoglossum,* with which this group was combined by van den Bosch. Prantl then restricted the application of the name *Didymoglossum* to this group, and renamed the real *Didymoglossum* as *Hemiphlebium.* Actually it is not *Didymoglossum,* but *Microgonium,* which has immediate affinity to *Crepidomanes.* Because *Microgonium* is evidently a group of reduced species, *Crepidomanes* is likely to have been the parent genus. I have thought[37] that *Crepidomanes* was "presumably derived from the group of *T. pyxidiferum,*" but am now as ready to share van den Bosch's view that it represents a coördinate evolutionary line, with some ultimate affinity to *Didymoglossum.* I do not believe, however, that the bilabiate mouth of the involucre betrays any real near affinity to *Hymenophyllum.*

The species are locally variable, and dwarfing is common. The series of dwarfs of various species converges with reduction, until the more extreme dwarfs of diverse origin tend to become indistinguishable. *T. Lenormandi,* which I list under *Microgonium,* is evidently a very reduced *Crepidomanes.*

SPECIES OF CREPIDOMANES

CHEPIDOMANES INTRAMARGINALE (H. and G.) Copeland comb. nov.

Trichomanes intramarginale Hooker and Greville, COPELAND, Trich. (1933) 189, pl. 23, figs. 1–3.

CEYLON; INDIA. The type species of the genus.

CREPIDOMANES BIPUNCTATUM (Poiret) Copeland comb. nov.

Trichomanes bipunctatum POIRET, Lam., Enc. 8 (1808) 69; COPELAND, Trich. (1933) 177, pl. 18, figs. 1–4.

Madagascar to Tahiti, with a gap in Malaya.

CREPIDOMANES BILABIATUM (Nees and Blume) Copeland comb. nov.

Trichomanes bilabiatum NEES and BLUME, Nova Acta 11 (1823) 123, pl. 13, fig. 2; COPELAND, Trich. (1933) 179, pl. 18, figs. 5, 6.

JAVA; SUMATRA.

CREPIDOMANES RUPICOLUM (Racib.) Copeland comb. nov.

Trichomanes rupicolum RACIBORSKI, Pterid. Buitenzorg (1898) 24; COPELAND, Trich. (1933) 181, pl. 19, fig. 2.

JAVA.

[37] Trich. (1933) 174.

CREPIDOMANES BREVIPES (Presl.) Copeland comb. nov.

Didymoglossum brevipes PRESL, Hymen. (1843) 139.

Trichomanes brevipes BAKER, Syn. Fil. 84; COPELAND, Trich. (1933) 182, pl. 20.

PHILIPPINES; GUAM; BORNEO.

CREPIDOMANES CHRISTII Copeland.

Trichomanes Christii COPELAND, Philip. Journ. Sci. 1 (1906) Suppl. 251; Trich. (1933) 185, pl. 21.

Philippines to Sumatra.

CREPIDOMANES VENULOSUM (Rosenst.) Copeland comb. nov.

Trichomanes bipunctatum var. *venulosa* ROSENSTOCK, Hedwigia 56 (1915) 350.

Trichomanes venulosum COPELAND, Trich. (1933) 186, pl. 22, figs. 1, 2.

NEW GUINEA.

CREPIDOMANES NYMANI (Christ) Copeland comb. nov.

Trichomanes Nymani Christ, SCHUM. and LAUT., Flora Südsee Nachtr. (1905) 36; COPELAND, Trich. (1933) 187, pl. 19, fig. 4.

NEW GUINEA.

CREPIDOMANES PERVENULOSUM (v. A. v. R.) Copeland comb. nov.

Trichomanes pervenulosum v. A. v. ROSENBURGH, Philip. Journ. Sci. § C 11 (1916) 103, pl. 5, fig. 2; COPELAND, Trich. (1933) 188, pl. 19; pl. 20, fig. 3.

AMBOINA.

CREPIDOMANES LATEMARGINALE (Eaton) Copeland comb. nov.

Trichomanes latemarginale EATON, Proc. Am. Acad. 4 (1859) 111; COPELAND, Trich. (1933) 189, pl. 24.

India to Formosa.

CREPIDOMANES MEGISTOSTOMUM Copeland.

Trichomanes megistostomum COPELAND, Trich. (1933) 191, pl. 23, figs. 4–6.

SIAM.

CREPIDOMANES LATEALATUM (v. d. B.) Copeland comb. nov.

Trichomanes latealatum VAN DEN BOSCH, Ned. Kruid. Arch. 5[2] (1863) 138; COPELAND, Trich. (1933) 192, pls. 25, 26.

INDIA.

There may be a considerable number of additional species in the Indo-Sino-Japanese region. More than a dozen have been named. I have seen authentic material of half of them and, comparing type collections only, would deem them distinct enough. Among most plants this would be a satisfactory test of specific

identity. In this particular group, however, the characteristics embodied in the descriptions are subject to such wide variation, that I prefer not to risk encumbering synonymy with new combinations of names until the examination of many collections may show that the several supposed species do not too freely overlap as they vary. The examination of very many collections has shown that a number of "species" described from the Philippines and Java, apparently distinct if the types only are compared, are forms of the fairly protean *C. brevipes* and *C. bilabiatum*.

22. Genus MICROGONIUM Presl

Microgonium PRESL, Hymen. (1843) 111; VAN DEN BOSCH, Hymen. Javan. 5.
Hemiphlebium § *Microgonium* PRANTL, Hymen. 48.

Typice epiphytica, rhizomate filiforme, intricato, velutino, radicibus saepe vel semper carentibus; frondibus remotis, minimis, integris vel lobatis, margine nudo, venatione flabellata vel pinnata, venulis spuriis praeditis, vernatione planis; soris epitactis marginalibus, involucro elongato, ore expanso vix bilabiato, receptaculo extruso.

Range: Old World Tropics, one species apparently American. Evidently derived, by reduction, from *Crepidomanes*.

SPECIES OF MICROGONIUM (SUBMARGINAL STRAND PRESENT)

MICROGONIUM BIMARGINATUM van den Bosch.

Microgonium bimarginatum VAN DEN BOSCH, Hymen, Javan (1861) 7.
Trichomanes bimarginatum VAN DEN BOSCH (1861); COPELAND, Trich. (1933) 208, pl. 33, figs. 1–4.

Malaya to Ceylon and Samoa.

MICROGONIUM MINDORENSE (Christ) Copeland comb. nov.

Trichomanes mindorense CHRIST, Philip. Journ. Sci. § C 3 (1908) 270; COPELAND, Trich. (1933) 209, pl. 34, figs. 1, 2.

MINDORO.

MICROGONIUM CRASPEDONEURUM Copeland.

Trichomanes craspedoneurum COPELAND, Philip. Journ. Sci. § C 7 (1912) 53; Trich. (1933) 208, pl. 33, figs. 5–7.

LUZON.

MICROGONIUM CUSPIDATUM (Willd.) Presl.

Microgonium cuspidatum (Willd.) PRESL, Hymen. 111, pl. 6*A*, the type of the genus.
Trichomanes cuspidatum WILLDENOW, Copeland, Trich. (1933) 210, pl. 32, figs. 6, 7.

East African Islands.

MICROGONIUM EROSUM (Willd.) Presl.

Trichomanes erosum WILLDENOW, Copeland, Trich. (1933) 210, pl. 34, figs. 3–6.

AFRICA.

Trichomanes lenormandi v. d. Bosch, of the Comores and Madagascar, belongs here by the original description; and *T. pygmaeum* C. Chr. clearly does so by definition.[38] But Christensen suspects that they are one species. And *T. Lenormandi* in its larger forms would better be regarded as a reduced *Crepidomanes*.

Related to this, but without any marginal vein, are *T. fulgens* C. Chr. and *T. Kirkii* Hooker, of the same region.

MICROGONIUM HOOKERI Presl.

Microgonium hookeri PRESL (1848).
Trichomanes hookeri PRESL, Hymen. 108, *non Didymoglossum hookeri* PRESL, ibid. 115.
Microgonium berteroanum PRESL, ibid. 112 *nomen*, 138, pl. 6*B*.

Cuba to Guiana. Submarginal strand absent.

MICROGONIUM SUBLIMBATUM (K. Müller) van den Bosch.

Microgonium sublimbatum (K. Müller) VAN DEN BOSCH, Hymen. Javan. 6, pl. 2.
Trichomanes sublimbatum K. MÜLLER, Copeland, Trich. (1933) 198, pl. 28, figs. 1, 2.

Assam to Papua.

MICROGONIUM HENZAIANUM (Parish) Copeland comb. nov.

Trichomanes henzaianum PARISH in Hooker, Second Cent. Ferns (1860) pl. 1; COPELAND, Trich. (1933) 198, pl. 28, figs. 3, 4.
Microgonium henzariense VAN DEN BOSCH.

MOULMEIN (or Tenasserim).

The involucre is obconic, but the false veins leave little doubt that this is a *Microgonium*.

MICROGONIUM MOTLEYI van den Bosch.

Microgonium motleyi VAN DEN BOSCH, Hymen. Javan. 5, pl. 1.
Trichomanes motleyi VAN DEN BOSCH, Copeland, Trich. (1933) 201, pl. 30, figs. 1–4.

BORNEO; MALAY PENINSULA; further range doubtful.

[38] Bonaparte, Notes Pterid. 12 : 13, pl. 10; Pterid. Madag. 2: figs.

MICROGONIUM BECCARIANUM (Cesati) Copeland comb. nov.

Trichomanes beccarianum CESATI, Atti Accad. Napoli 7 pt. 8 (1876) 8, pl. 1, fig. 2; COPELAND, Trich. (1933) 200, pl. 29.

Ceylon to Formosa and the Solomon Islands.

The key, p. 197, of my treatise on Trichomanes, is in error as to this species, but the latter is correctly distinguished from *T. cultratum* in the text.[39]

MICROGONIUM CULTRATUM (Baker) Copeland comb. nov.

Trichomanes cultratum BAKER, Journ. Bot. 17 (1879) 293; COPELAND, Trich. (1933) 202, pl. 30, figs. 5–7.

FIJI; QUEENSLAND.

MICROGONIUM OMPHALODES Viellard.

Microgonium omphalodes VIELLARD.
Trichomanes omphalodes C. Chr., COPELAND, Trich. (1933) 203, pl. 31, figs. 1–6.
Trichomanes peltatum BAKER (non Poiret) Journ. Linn. Soc. 9 (1866) 336, pl. 80; GIESENHAGEN, Hymen., figs. 14–26.

Java to Tahiti.

Hymenophyllum parvifolium Baker, Moulmein, was described by both Baker and Kuhn as having striæ, but no veins except the costæ. It may be a very small *M. henzaianum.*

Trichomanes Hildebrandtii Kuhn, from the Comores, apparently collected only once, and scantily, is superficially very like *M. omphalodes;* it is larger, but *M. omphalodes* is variable in size. I have specimens of *M. omphalodes* more than 25 mm in diameter, although 10 mm is a commoner size. The known range being from Tahiti to Java, extension to the African islands would not be surprising. However, Giesenhagen[40] has found, beside minor differences, that the lamina of *T. Hildebrandtii* is several cells thick, with the chlorophyll confined to the upper superficial layer. It is, of course, no *Trichomanes,* in my use of that name; but, without a specimen, I do not know whether or not it is a *Microgonium.*

In my treatises on Trichomanes and on Hymenophyllum I have had repeatedly to emphasize the fact that simplification in form, and eventually in structure, is a natural concomitant of reduction in size; and that, in the course of simplification, the characteristics which indicate affinity and ancestry may more

[39] Pages 202, 203. [40] Hymen. 449–452, figs. 1, 5.

or less completely disappear, with the result that reduced plants of diverse ancestry may be very much alike.

In *Didymoglossum* and *Microgonium* we are dealing with plants as reduced as we know in the family; and must recognize the fact that so far as the group of characters which have commonly served for specific diagnosis are concerned, descendants of almost any larger plants of the old genus *Trichomanes*, reduced to this point, might be regarded as conspecific. *Trichomanes muscoides* has been construed broadly and variously enough to illustrate this fact. Recognizing the difficulty of detecting real affinity among such reduced plants, I intended first to combine them, as *Didymoglossum*, and avow lack of confidence in the unity of such a genus. In particular the Oriental species have looked like derivatives of *Crepidomanes* (*Taschneria*), which is confined to the Old World, and I have hesitated to regard a pantropic group as derived from one of limited range and, therefore, presumably younger.

Study of the available American material, representing the generally accepted species, has now shown that they have a common significant character, in the possession of marginal setæ, which are wanting on all species of the Malay-Polynesian region. On the strength of this distinction, already emphasized by Prantl,[41] I now regard the Oriental group, without setæ, as genetically distinct, and related to *Crepidomanes*, which has much the same range. *Microgonium Hookeri* is the only species falling outside this geographic range, and I may be in error in including it; it may be a very aberrant member of *Didymoglossum*. However, the expanded, nonbilabiate involucre of *D. Petersii* arouses no doubt as to its affinity, any more than does the symmetrically expanded mouth of *Crepidomanes Christii*, in a genus otherwise characterized by somewhat bilabiate mouths.

23. Genus CALLISTOPTERIS Copeland gen. nov.

Epiphyticae, rhizomate valido adscendente; stipitibus caespitosis, teretibus, setosis; frondibus magnis, basi plus minus angustatis, quadripinnatifidis segmentis linearibus tenuiter membranaceis; parietibus tenuibus; involucris immersis, obconicis, ore truncato vel subbilabiato, receptaculo exserto.

Typus: C. apiifolia (Presl sub Trichomane).

[41] Hymen. 46.

A small, well-marked group, the showiest in the family. Range: Malaya across Polynesia.

SPECIES OF CALLISTOPTERIS

CALLISTOPTERIS APIIFOLIA (Presl) Copeland comb. nov.

Trichomanes apiifolium PRESL, Hymen. (1843) 108, 136; VAN DEN BOSCH, Hymen. Javan. 26, pl. 19; COPELAND, Trich. (1933) 227, pl. 42, fig. 1.

Sumatra to Samoa.

CALLISTOPTERIS BAUERIANA (Endl.) Copeland comb. nov.

Trichomanes bauerianum ENDLICHER, Prod. Fl. Norfolk (1833) 17; COPELAND, Trich. (1933) 229, pl. 42, fig. 2.

NORFOLK; LORD HOWE ISLAND.

CALLISTOPTERIS POLYANTHA (Hooker) Copeland comb. nov.

Hymenophyllum polyanthum HOOKER, Nightingale, Oceanic Sketches (1835) 132.

Trichomanes polyanthum Hooker, COPELAND, Trich. (1933) 230, pl. 42, fig. 3.

Trichomanes societense[42] J. W. MOORE, Bishop Mus. Bull. 102 (1933) 5.

SOCIETY ISLANDS.

CALLISTOPTERIS BALDWINII (Eaton) Copeland comb. nov.

Hymenophyllum Baldwinii EATON, Bull. Torr. Bot. Club 6 (1879) 293.

Trichomanes Baldwinii COPELAND, Trich. (1933) 230, pl. 42, figs. 4–8.

HAWAII.

24. Genus NESOPTERIS Copeland gen. nov.

Terrestres, rhizomate valido suberecto, stipitibus caespitosis, longis, sursum anguste alatis ala decidua; frondibus magnis, quadripinnatifidis, basi vix angustatis, segmentis linearibus, costis pilis minutis clavatis obsitis; cellulis parvis, parietibus tenuibus rectis, involucris cylindricis alatis, receptaculis exsertis.

Typus: N. grandis (Copel. sub Trichomane).

A small, well-marked genus, superficially somewhat like *Selenodesmium*, with larger, less rigid, more finely dissected fronds, and very different structure. More like *Callistopteris*, from which it differs in the firmer texture, in habitat, pubescence, and

[42] This name is proposed on the ground that "*polyanthum*" is an orthographic variant of "*polyanthus*" which I do not believe. The Greek equivalent of "polyanthus" is "polyanthes." If Swartz had used that word, it would invalidate Hooker's specific name. Swartz made up his word; I am not sure what it is, but take it to be a noun used as an adjective. And a noun and an adjective are not orthographic variants.

shape of involucre. The three seem to be phyletically distinct, probably independently related to (derived from) the group of *Vandenboschia radicans*. *V. maxima* represents more definitely the source of *Nesopteris*.

Range: Loochoo and Java to Samoa; unknown on the continent, and hence named the island fern.

SPECIES OF NESOPTERIS

NESOPTERIS GRANDIS Copeland.

Trichomanes grande COPELAND, Philip. Journ. Sci. § C 6 (1911) 70; Trich. (1933) 224, pl. 40. figs. 1–4.

Trichomanes preslianum NAKAI, Bot. Mag. Tokyo 40 (1926) 261.

PHILIPPINES; JAVA.

NESOPTERIS THYSANOSTOMA (Makino) Copeland comb. nov.

Trichomanes thysanostomum MAKINO, Bot. Mag. Tokyo 12 (1898) 193 *nomen;* 13 (1899) 46.

Trichomanes blepharistomum COPELAND, Trich. (1933) 225, pl. 41.

LOOCHOO; LUZON.

NESOPTERIS INTERMEDIA (v. d. B.) Copeland comb. nov.

Trichomanes intermedium VAN DEN BOSCH, Ned. Kruid. Arch. 5 (1861) 179; Journ. Bot. Neerl. 1 (1861) 361; COPELAND, Trich. (1933) 226, pl. 40, fig. 5.

PAPUA; POLYNESIA.

NESOPTERIS SUPERBA (Backhouse) Copeland comb. nov.

Trichomanes superbum BACKHOUSE, Moore, Gard. Chron. (1862) 44; COPELAND, Trich. (1933) 221, pl. 39.

BORNEO.

25. Genus CEPHALOMANES Presl

Cephalomanes PRESL, Hymen. (1843) 109, pl. 5.

Venae pinnatim exorientes, creberrimae, prominulae, uni- bifurcatae, venulisque sterilibus apice obtuso liberae. Sorus in dentibus frondis obliteratis terminalis, pedicellatus. Indusium cylindraceum, limbo patente integro. Receptaculum indusio dimidio duplove longius, rectum, rigidulum, cylindricum, apice in globum incrassatum, basi capsuliferum. Capsulae sessiles, lenticulares.

Species. Cephalomanes atrovirens.—PRESL, loc. cit.

Terrestre, rhizomate valido adscendente vel erecto, radicibus validis obscuris sustenso; stipitibus dense fasciculatis, setosis, rigidis; fronde plerumque lanceolata, simplice pinnata, obscura, rigidula, venis crassis saepe in dentes vel lacinias ultra marginem protensis; cellulis magnis, parietibus in proportione tenuibus, undulatis; involucris cylindricis (rarius obconicis) rigidis, receptaculo crasso longe exserto.

A small and very natural genus of the Oriental Tropics, derived from the group of *Vandenboschia radicans*. *V. auriculata*, which I leave in the latter group, but which van den Bosch treated as *Cephalomanes*, illustrates the course of evolution of the daughter genus. The globose tip of the receptacle, responsible for the generic name, was illusory or very exceptional, although Presl depicted it for a second species, *C. oblongifolium*.[43]

Range: Malaya to India and across Polynesia.

SPECIES OF CEPHALOMANES

CEPHALOMANES JAVANICUM (Blume) van den Bosch.

Cephalomanes javanicum VAN DEN BOSCH, Hymen. Javan. 30, pl. 22.
Trichomanes javanicum Blume, COPELAND, Trich. (1933) 246, pl. 52, fig. 1.

Java to India (and Papua?).

CEPHALOMANES SINGAPORIANUM van den Bosch.

Cephalomanes singaporianum VAN DEN BOSCH, Synopsis (1859) 11.
Trichomanes singaporianum v. A. v. Rosenburgh, COPELAND, Trich. (1933) 247, pl. 52, fig. 5.

SINGAPORE; MALAY PENINSULA; BORNEO.

CEPHALOMANES SUMATRANUM (v. A. v. R.) Copeland comb. nov.

Trichomanes sumatranum v. A. v. ROSENBURGH, Bull. Dept. Agr. Ind. Neerl. No. 18 (1908) 4; COPELAND, Trich. (1933) 248, pl. 52, fig. 4.

SUMATRA; BORNEO; ANNAM.

CEPHALOMANES OBLONGIFOLIUM Presl.

Cephalomanes oblongifolium PRESL, Epim. Bot. 19, pl. 10.
Trichomanes asplenioides PRESL, Hymen. (1843) 129, *non* Swartz; KUNZE, Farnkr. 218, pl. 89; COPELAND, Trich. (1933) 249, pl. 52, fig. 2; pl. 55, fig. 10.

PHILIPPINES; AMBOINA; BORNEO; FORMOSA; SOLOMON ISLANDS.

CEPHALOMANES ATROVIRENS Presl.

Cephalomanes atrovirens PRESL, Hymen. (1843) 110, pl. 5, the generic type.
Trichomanes atrovirens Kunze, COPELAND, Trich. (1933) 251, pl. 52, fig. 3; pl. 55, fig. 2.

PHILIPPINES; NEW GUINEA; QUEENSLAND.

CEPHALOMANES DENSINERVIUM Copeland.

Trichomanes densinervium COPELAND, Philip. Journ. Sci. § C 6 (1911) 71; Trich. (1933) 253, pl. 53, fig. 1.

NEW GUINEA.

[43] Epim. Bot., pl. 10.

CEPHALOMANES KINGII Copeland.

Trichomanes Kingii COPELAND, Philip. Journ. Sci. § C 6 (1911) 72; Trich. (1933) 253, pl. 53, fig. 2.

NEW GUINEA.

CEPHALOMANES ACROSORUM Copeland.

Trichomanes acrosorum COPELAND, Philip. Journ. Sci. § C 6 (1911) 72; Trich. (1933) 254, pl. 53, fig. 3.

NEW GUINEA.

CEPHALOMANES BORYANUM (Kunze) van den Bosch.

Cephalomanes boryanum VAN DEN BOSCH, Synopsis (1859) 11.
Trichomanes boryanum KUNZE, Farnkr. 237, pl. 97; COPELAND, Trich. (1933) 254, pl. 52, fig. 4.

POLYNESIA.

Cephalomanes madagascariense van den Bosch, Synopsis 11, is a doubtful species; cf. Christensen, Pterid. Madagascar (1932) 5.

Trichomanes Foersteri Rosenstock, of Sumatra, is unknown to me.

Trichomanes crassum Copel.[44] is certainly *Cephalomanes*, but, being known sterile only, may be suspected of being hybrid or monstrous. LEYTE (Philippines).

26. Genus TRICHOMANES Linnæus

Trichomanes LINNÆUS, Sp. Plant. (1753) 1097.
Trichomanes § *Achomanes* PRESL, Hymen. (1843) 105.
Ragatelus PRESL, Hymen. (1843) 108.
Neurophyllum PRESL, Hymen. (1843) 110, *non* Torrey et Gray.
Odontomanes PRESL, Epim. Bot. (1849) 16.
Neuromanes TREVISAN (1851); VAN DEN BOSCH, Synopsis 7.
Ptilophyllum VAN DEN BOSCH (1861); PRANTL, *partim; non* Morris *nec aliorum.*
Lacostea VAN DEN BOSCH (1861); PRANTL, *pro parte minore.*

Although the era of our botanic nomenclature began with the publication of Linnæus' Species Plantarum in 1753, genera are not defined in that work. For Linnæan generic definitions and, therefore, for the typification of his genera, we must go to earlier works of the same author.[45] In the case of *Trichomanes* it is

[44] Trich. (1933) 256, pl. 54; pl. 55, fig. 3.

[45] The latest rule sends us to the next subsequent edition of the "Genera," but, to interpret the definition found there, we must still go back to the first edition, where the same definition is amplified by references which fix the type.

defined in the Corollarium Genera Plantarum (and, *teste* Underwood, in *Hortus Cliffortianus,* also dated 1937): "Calyx turbinatus, solitarius, erectus, ex ipso margine folii. Stylus setaceus capsulam terminans." No species is mentioned, but reference is made to Plumier [46] for an illustration. This is *Trichomanes crispum.* As Linnæus's generic concept finds its first expression here, and no other species is mentioned or referred to, this species must be accepted as the type species of the genus.

The genus typified by this species may be a small but natural one, pinnatifid or simply pinnate, mostly bearing long, soft hairs, with rather close veins tending to be parallel, restricted to the American Tropics, being then Presl's section *Achomanes,* van den Bosch's and Prantl's genus *Ptilophyllum;* or it can be a much larger, still natural, genus, including a number of such more or less definable groups, and found in all moist tropical and most warm-temperate regions. I use it in the former sense and diagnose it accordingly:

Typically terrestrial American ferns; fronds typically uniform, pinnatifid to pinnate in plan, false veinlets rarely present, and then between and parallel to the veins, lamina one cell thick except immediately along veins; involucre obconic to cylindric, the mouth truncate to expanded, but not valvate or bilabiate, receptacle slender and protruding; sporangia rather small, and with a limited number of wall cells.

That *T. crispum* is not congeneric with *T. scandens* L., *T. radicans* Sw., and *T. pyxidiferum* L. has been the belief of nearly every author who undertook to break the huge group called *Trichomanes* in the general treatises on ferns into smaller, natural genera. By the principles of the typification of genera now generally accepted, van den Bosch and Prantl erred in keeping the name for the larger, more primitive, cosmopolitan group of *T. radicans,* and introducing a new name, *Ptilophyllum,* for *Trichomanes* as properly typified. To this extent they had justification, that they left in *Trichomanes* the larger number of species. If, however, they had observed any rule at all, they would have adopted, for the group including *T. crispum,* Presl's name *Ragatelus,* based on the nearly related *T. crinitum,* in spite of the fact that Presl erected the genus on an erroneous figure and without seeing the plant. Presl based *Cephalomanes* on an equally baseless or imaginary character; but van den Bosch re-

[46] Fil. 86.

tained that genus and quoted Linnæus in justification: "Nomen genericum dignum alio, licet aptiore, permutare non licet." [47]

To place some limit on the number of new binomials which have to result from the typification of the genus by *T. crispum*, I have construed it as broadly as I could—except as it might include *Feea*. *Odontomanes* might, about as reasonably as *Feea*, be given generic status; the group is natural and definable, but its affinity to *T. crispum* is reasonably clear. And, if one would give generic status to every definable and apparently natural group, *Neuromanes* could be recognized, along with *Odontomanes*.

The reduction of *Ptilophyllum* and *Lacostea* to one genus is a somewhat different proposition. Van den Bosch and Prantl, who are responsible for both, were careful students of these ferns. Prantl laid particular stress on the system of branching and the position of the sori. Subordinating all other considerations to these, he divided the great group which might be called *Trichomanes*, after the elimination of such more clearly distinct, smaller, related groups as *Didymoglossum* (in the sense of Desvaux), into *Ptilophyllum*, *Lacostea*, and *Trichomanes*, the latter including *T. pyxidiferum* and *T. radicans*. Prantl's criteria are useful in some groups of ferns, but not here. *Lacostea* was to be characterized by anadromic venation and paratact sori, in distinction to *Ptilophyllum*, and limited dissection of the frond, in distinction to *Trichomanes*. He included in it *T. javanicum*, not knowing *T. asplenioides* Presl (properly *Cephalomanes oblongifolium*), which even until Christensen has been reduced to *T. javanicum*, although its sori are epitact. Among American species both van den Bosch and Presl placed *T. alatum* (as *P. ptilodes*) in *Ptilophyllum*, although to me it seems clearly to be close to *Lacostea* (*T. pedicellatum*); and also to *T. luschnatianum* (*T. rupestre*) which they left in *Trichomanes*. At this point, though, we come to what I regard as a likely genetic connection between my *Trichomanes* and that of Prantl, so that one has reasonable freedom of choice as to where he will leave *T. rupestre*.

Another character of generic value in many cases is the elongation of the rhizome, commonly correlated with the remoteness of the leaves, and with their arrangement, as distichous or polystichous. However good a generic character in many or

[47] Synopsis 10.

most groups, it is not even a specific character in others—*T. meifolium*, for example. In *Trichomanes* it will not serve even for natural subgeneric grouping. In the family in general the elongate rhizome is primitive. Regarding *Vandenboschia* as ancestral to *Trichomanes*, I suggest *T. ruprestre* as a primitive element in *Trichomanes*, as shown by both the slender, elongate rhizome and the dissection of the frond. But it does not appear that all species with clustered fronds, or all species with elongate rhizomes, constitute a natural group. Both types of rhizome appear even in *Feea*, derived from a *Trichomanes* group in which most of the species have the fronds clustered on a suberect rhizome.

Another feature of generic value in many cases, but not here, is hairyness, as hairs may be absent on the lamina, or present and of particular form. Most species of section *Ptilophyllum* bear long, weak hairs. This character is unstable also in *Vandenboschia* and *Feea*.

Range: Tropical America, extending a little beyond the Tropics.

SPECIES OF TRICHOMANES

Fronds bipinnatifid: Approximately *Lacostea* van den Bosch.

TRICHOMANES RUPESTRE (Raddi) van den Bosch.

Tropical South America.

T. venustum Desv. is a more divided form, from Central America.

TRICHOMANES ANKERSII Parker.

Trinidad to Brazil.

TRICHOMANES TANAICUM Hooker.

BRAZIL.

TRICHOMANES PEDICELLATUM Desvaux.

Tropical America (BRAZIL).

The three preceding species are *Lacostea;* the following three, called *Ptilophyllum*, seem to me to be as near to *Lacostea*.

TRICHOMANES ALATUM Swartz.

West Indies to Brazil. Stipes usually tufted, rarely subremote.

TRICHOMANES FIMBRIATUM Backhouse.

TRINIDAD; GUIANA.

TRICHOMANES ARBUSCULA Desvaux.

West Indies to Brazil and Peru.

TRICHOMANES ANADROMUM Rosenstock.

COSTA RICA.

Trichomanes bicorne Hooker is a more divided relative of *T. alatum,* from the Amazon; and *T. amazonicum* Christ is described as a local relative with less divided fertile fronds.

Fronds pinnate or pinnatifid, veins free: *Ptilophyllum* van den Bosch.

TRICHOMANES POLYPODIOIDES Linn.

Cuba and Mexico to Uruguay. Rhizome elongate.

TRICHOMANES CRINITUM Swartz.

Jamaica and Costa Rica to Ecuador.

TRICHOMANES CRISPUM Linnæus. Plate 8.

Cuba to Ecuador and Brazil. The type of the genus.

TRICHOMANES ACCEDENS Presl.

West Indies across Brazil.

TRICHOMANES SELLOWIANUM Presl.

Tropical America (BRAZIL).

TRICHOMANES CRISTATUM Kaulfuss.

Tropical America (BRAZIL).

TRICHOMANES GALEOTTII Fournier.

MEXICO; HONDURAS; CUBA.

TRICHOMANES PELLUCENS Kunze.

Tropical America (BRAZIL).

TRICHOMANES PILOSUM Raddi.

Guiana across Brazil.

TRICHOMANES LAXUM Kl.

Tropical America (BRAZIL).

TRICHOMANES LINDIGII Fournier.

COLOMBIA; BRAZIL.

TRICHOMANES LUDOVICIANUM Ros.

COSTA RICA.

Frond pinnate, veins cross-connected by false veinlets: *Neuromanes* Trev.

TRICHOMANES PINNATUM Hedwig.

Cuba and Mexico to Brazil.

TRICHOMANES VITTARIA D. C.

GUIANA; AMAZON.

Fertile frond simple. Frond pinnate, veinlets anastomosing: *Odontomanes* Presl.

TRICHOMANES HOSTMANNIANUM (Kl.) Kunze.

GUIANA; AMAZON.

I have enumerated, with one exception, only the species in hand; and suppose that all American species which have been referred to *Ptilophyllum* as genus or subgenus are correctly placed there. The Oriental species so referred by van Alderwerelt do not belong here. Prantl was likewise wrong, in principle as well as in form, in referring to *Lacostea* the Oriental *Cephalomanes*. The latter presents a most interesting example of evolution parallel in form to that of *Trichomanes*, the two originating independently in *Vandenboschia*.

27. Genus FEEA Bory

Feea BORY, Dict. Class. d'Hist. Nat. 6 (1824) 446; PRESL, Hymen., (1843) 102; VAN DEN BOSCH, Synopsis, 6.
Hymenostachys BORY, Dict. Class. d'Hist. Nat. 6 (1824) 588; 8 (1825) 462; PRESL, Hymen. (1843) 103.
Homoeotes PRESL, Abh. böhm. Ges. Wiss. V 5 (1848) 331 (not seen).
Trichomanes subgenus *Feea* et *Hymenostachys* HOOKER, Sp. Fil. 1 (1846) 114.
Trichomanes § *Feea*, HOOKER and BAKER, Syn. Fil. 71.
Ptilophyllum § *Homoeotes* et *Feea*, PRANTL, Hymen., 48.

Genus Trichomane (ex affinitate T. crispi) derivatum, terrestre, rhizomate aut brevi-repente aut suberecto et radicibus validis sustenso, stipitibus subremotis vel caespitosis; frondibus dimorphis, sterilibus lanceolatis profunde pinnatisectis (deorsum rarius pinnatis) segmentis integris, fertilibus linearibus; aliter Trichomane conforme.

Tropical America, from the Amazon basin to the Caribbean, one species extending into Central America and one into the West Indies.

SPECIES OF FEEA

FEEA HETEROPHYLLA (H. B. W.) Copeland comb. nov.

Trichomanes heterophyllum H. B. W. in Willdenow, Sp. Pl. 5 (1810) 503.
Homoeotes heterophylla PRESL.

Feea Humboldtii VAN DEN BOSCH, Ned. Kr. Arch. 4 (1859) 347.
Feea spruceana VAN DEN BOSCH, ibid.

Amazon basin, Guiana.

FEEA DIVERSIFRONS (Bory) Copeland comb. nov.

Hymenostachys diversifrons BORY, Dict. Class. d'Hist. Nat. 8 (1825) 462.
Feea Boryi VAN DEN BOSCH.

Guiana to southern Mexico and Bolivia.

FEEA TROLLII (Bergdolt) Copeland comb. nov.

Trichomanes Trollii BERGDOLT, Flora 127 (1933) 264, text figs.

BOLIVIA; GUIANA?

FEEA BOTRYOIDES (Kaulfuss) van den Bosch.

Trichomanes botryoides KAULFUSS.
Feea nana BORY, the type of the genus.

GUIANA; PANAMA; PERU.

FEEA OSMUNDOIDES (DC.) Copeland comb. nov. Plate 9.

Trichomanes osmundoides DC., in Poiret (Lam.) Enc. 8 (1808) 65.
Feea polypodina BORY, Dict. Class. d'Hist. Nat. 6 (1824) 446.
Feea spicata PRESL, Abh. böhm. Ges. V 5 (1848) 330.

Guiana to West Indies and Ecuador.

There remains *Trichomanes platyrachis* Domin, of Jamaica, which I have not seen. As it has been found but once, in a thoroughly collected locality, it seems likely to be an aberrant individual specimen of *F. osmundoides.*

These five species seem, with a sufficient measure of probability, all to be derived from the immediate group of *Trichomanes crispum;* as that species is construed in Species Filicum, they may all be derived from it. On the assumption that they represent a natural derived group, I treat them as one genus; but it must be conceded that this assumption is not as well grounded as is that of their common descent from a single group. That is, they may represent two, or even three, independent derived lines, from a common source.

Feea heterophylla, Presl's genus *Homoeotes,* has a somewhat elongate rhizome with seriate, not clustered, stipes. The fertile frond is pinnatifid, with numerous, closely placed, short, truncate segments, each (except near the apex of the frond) bearing several sori, which collectively form a border on the frond. Goebel [48] has clearly established its affinity to "*T. cris-*

[48] Flora 124 (1930) 381–388.

pum." I have several of the *Luetzelburg* specimens, and so know exactly what his *T. heterophyllum* is, but cannot so definitely locate his *T. crispum.* It was like *T. heterophyllum* in pubescence. As to the length of the rhizome, Goebel is silent. Broadly construed, *T. crispum* includes forms variable in pubescence and in the character of the rhizome—18 species of various authors, according to Synopsis Filicum, 25 by this time.[49]

Feea diversifrons (Bory's genus *Hymenostachys*) and *F. Trollii* have entire fertile fronds, the marginal sori sunk in the lamina. The pubescence is comparatively scant and uniform, distinct from that of *F. heterophylla,* but within the range of *T. crispum s. lat.* The rhizome is short and the fronds tufted, as in the typical *T. crispum.* This pair of species is treated in most detail by Bergdolt.[50]

Feea botryoides and *F. osmundoides* (Bory's genus *Feea*) have the lamina elided between the sori which stand side by side on an almost wingless rachis. The fronds are tufted on a suberect rhizome.

The fact that the plants I combine in a genus *Feea* show affinity to at least two groups of plants, whether or not the latter are well regarded as belonging in a single species, is not proof that my *Feea* is diphyletic or polyphyletic (except in the sense in which every human family becomes more so by amphimixis with each generation). Because dimorphism is a rare phenomenon in Hymenophyllaceæ, it seems probable that as a genetic change (or mutation), the nearly related plants which exhibit it result from one such occurrence. The difference in rhizome and in pubescence may be the result of parallel evolution—which Bergson might have expected to happen. More probably, in my own present view, they are due to hybridization.

Some species of *Feea* have conspicuous peculiarities not found in *T. crispum* or its immediate group. Thus *F. diversifolia* has the lamina of the fertile frond several cells thick. I treat this as an important generic characteristic of *Davalliopsis,* and as one such character of *Cardiomanes* and *Hymenoglossum,* but as of minor significance or utility in the cases of *Mecodium dilatatum* and its relatives. In the case of *F. diversifolia,* it looks like an almost inevitable mechanical consequence of the congestion of the sori. Other *Feea* species show a tendency to be more

[49] Maxon, Pterid. of Porto Rico (1926) 501.
[50] Flora 127 (1933) 251.

than one cell thick.[51] Striæ (false veinlets) occur in some species. *F. diversifolia* has veins excurrent from the costa, as in the group of *T. pinnatum*.

F. diversifrons and *F. Trollii* have anastomosing veins, a feature as unique in this family as is the dimorphism.

We have then a choice of three courses:

1. To leave these ferns in *Trichomanes*. Its ancestry is there, and there is some dimorphism at two other places in this parent genus.

2. To recognize two or three genera, here combined as *Feea*.

3. To treat the group of five species as one genus. I have chosen this course because it seems to give expression most conveniently to the noteworthy common characteristics of this group of related species.

It may be noted here, though the subject is a *Trichomanes*, that Christ referred to "Sect. Feea" his *T. amazonicum*[52] described as distinguished from *T. bicorne* Hooker, found at the same place, by having the fertile fronds bipinnatifid, while the sterile fronds, like all fronds of *T. bicorne*, are tripinnatifid. Christ injected this foreign element into *Feea*, and then condemned the latter for not being a natural group.

The remaining dimorphous *Trichomanes* is *T. Vittaria*, derived from *T. pinnatum*. It is the type of Presl's genus *Neurophyllum*, this name being untenable for it. It was characterized essentially by the venation, and included *T. pinnatum*. Trevisan and van den Bosch called this group *Neuromanes*, but its proper name, if it is treated as a genus, is probably *Odontomanes*.

28. Genus DIDYMOGLOSSUM Desvaux

Didymoglossum DESVAUX, Prod. (1827) 330.

Didymoglossum PRESL, Hymen. (1843) 114; VAN DEN BOSCH, Synopsis 39, *partim*.

Hemiphlebium PRESL, Hymen. (1843) 117; PRANTL, Hymen. 45; *non Didymoglossum* VAN DEN BOSCH, Hymen. Javan. 35; *nec.* Prantl *ut sect. Trichomanes*, Hymen. 52.

Sori marginales exserti; sporangia sessilia receptaculo communi cylindraceo inserta; involucrum urceolatum ore hiante biligulatum. Habitus Trichomanidis.—DESVAUX, loc. cit.

Typice epiphytica, radicibus (an semper?) carentibus, rhizomate filiforme, intricato, velutino; frondibus remotis, aut parvis

[51] Mettenius, Abh. d. Math.-plys. Classe d. k. Sächs. Ges. Wiss. 7 (1864) 461.

[52] Hedwigia 44 (1935) 359.

aut minimus, pinnatifidis vel saepius integris, margine setiferis, venulis aut pinnatim aut flabellatim insertis, venulis spuriis interspersis; soris marginalibus, involucro elongato, ore typice bilabiato, receptaculo extruso.

Range: Tropical and subtropical America, across Africa to Ceylon, on trees and rocks in wet places.

The false veinlets and bilabiate involucre suggest affinity to *Crepidomanes*, which, however, is probably very remote; the marginal hairs, to *Sphaerocionium*. I suspect more real affinity to *Trichomanes* (*Lacostea*).

SPECIES OF DIDYMOGLOSSUM

DIDYMOGLOSSUM ROBINSONII (Baker) Copeland comb. nov.

Trichomanes Robinsonii BAKER, Journ. Linn. Soc. 9 (1867) 339, pl. 8 B.

Trichomanes montanum Hooker *non* Salisb. and *T. quercifolium* Hook. and Grev., *non* Desv. are synonymous or nearly so.

NATAL; MADAGASCAR; Tropical America.

DIDYMOGLOSSUM KRAUSSII (Hook. and Grev.) Presl.

Cuba to Brazil.

DIDYMOGLOSSUM REPTANS (Sw.) Presl.

WEST INDIES; VENEZUELA; COLOMBIA.

DIDYMOGLOSSUM HYMENOIDES (Hedwig) Copeland comb. nov.

Trichomanes hymenoides HEDWIG, Fil. Gen. et Sp. (1799) pl. 4, fig. 3.

Trichomanes muscoides SWARTZ (1801).

Didymoglossum muscoides DESVAUX, the type of the genus.

Jamaica to Brazil.

DIDYMOGLOSSUM PUNCTATUM (Poiret) Desvaux.

Cuba to Brazil.

DIDYMOGLOSSUM SPHENOIDES (Kunze) Presl.

Florida to Brazil.

DIDYMOGLOSSUM PUSILLUM (Sw.) Desvaux.

Cuba to Venezuela; the type of *Hemiphlebium*.

DIDYMOGLOSSUM SOCIALE Fée.

BRAZIL.

DIDYMOGLOSSUM CORDIFOLIUM Fée.

WEST INDIES; GUIANA.

DIDYMOGLOSSUM FONTANUM (Lindm.) Copeland comb. nov.

Trichomanes fontanum LINDM., Arkiv. Bot. 1 (1903) 44.

BRAZIL.

DIDYMOGLOSSUM PABSTIANUM (K. Müller) van den Bosch.

BRAZIL.

DIDYMOGLOSSUM LINEOLATUM van den Bosch.

Florida to Colombia. Without unconnected veinlets. *Trichomanes Curtii* Rosenstock, of Costa Rica, is hardly distinct.

DIDYMOGLOSSUM PETERSII (Gray) Copeland comb. nov.

Trichomanes Petersii GRAY, Am. Journ. Sci. II 15 (1853) 326.

Georgia to Mississippi. The involucre is not bilabiate.

DIDYMOGLOSSUM LIBERIENSE Copeland.

Trichomanes liberiense COPELAND, Trich. (1933) 160, pl. 9, figs. 316.

LIBERIA.

DIDYMOGLOSSUM EXIGUUM (Beddome) Copeland comb. nov.

Hymenophyllum exiguum BEDDOME, Ferns Brit. India (1868), pl. 275.
Trichomanes exiguum Baker, COPELAND, Trich. (1933) 205, pl. 32, figs. 1, 2.

CEYLON.

DIDYMOGLOSSUM WALLII (Thwaites) Copeland comb. nov.

Trichomanes Wallii THWAITES, Trimen, Journ. Bot. 23 (1885) 274; COPELAND, Trich. (1933) 206, pl. 32, figs. 3–5.

CEYLON.

Trichomanes Giesenhagenii C. Chr., Comores, evidently belongs here.

Trichomanes Barklianum Baker, Mauritius, may belong here, but is without false veins, and the involucre is not bilabiate.

In spite of a general indisposition to creating new binomials for species not known to me personally, I do so for the following three, because the identity of the species seems to be well established by the comparative and comprehensive study of Lindman.[53]

DIDYMOGLOSSUM MELANOPUS (Baker) Copeland comb. nov.

Trichomanes melanopus BAKER, Syn. Fil. (1874) 465; LINDMAN, loc. cit. 28, figs. 11–14.

ECUADOR.

DIDYMOGLOSSUM MOSENII (Lindm.) Copeland comb. nov.

Trichomanes Mosenii LINDMAN, loc. cit., 46, figs. 25 *D*, *E*; fig. 27.

BRAZIL.

[53] Ark. för Bot. (1903) 7–55.

DIDYMOGLOSSUM MYRIONEURON (Lindm.) Copeland comb. nov.

Trichomanes myrioneuron LINDMAN, loc. cit., 48, figs. 25, *E–I*, 28, 29.

GUIANA; BRAZIL; COSTA RICA?

VENEZUELA.

T. goebelianum Gies., another "smallest of all ferns," the frond 2.5 to 3 mm long, is a *Didymoglossum* with aberrant involucre, obconic, half-immersed, with broad, unbordered lips.

29. Genus LECANIUM Presl [54]

Lecanium PRESL, Hymen. (1843) 103, pl. 1.

Costa nulla. Venae flabellatae, creberrimae, subparallelae, pluries furcatae, crassiores apice soriferae. Venulae tenuissimae in superiori parte frondis libere exorientes et squamas duas oppositas supramarginales pateraeformes patentes gerentes. Sorus intramarginalis, immersus. Indusium lineari-cylindricum, elongatum, limbo hypocraterimorpho patente crenulato. Capsulae receptaculo filiformi indusium longe excedenti undique affixae, sessiles, angulato-lenticulares, valde excentrice (pone marginem) affixae.

Species. Lecanium membranaceum (Trichomanes membranaceum L.). —PRESL, loc. cit.

The genus was maintained by van den Bosch in his Bijdrage, and placed in his suborder Diploophyllaceæ. Prantl [55] treated it as a subgenus of his *Hemiphlebium*. All other authors have left it in *Trichomanes*.

[54] The validity of this name is challenged on two grounds: That *Achomanes* Necker is an older name, validly published, and appropriate; and that *Lecanium* Presl (1843) is invalidated by *Lecanium* Reinwardt (1825). As to the first: *Achomanes* Necker does seem to have been published properly under the Revised Statutes of 1930, for the first time since we had rules backed by the authority of a Congress. No species was ever named in the genus. It would have included several of the genera of later writers, and Presl, Hymenophyllaceae 107, made a competent election among these; he restricted it (with the status of a section) to that one group, explicitly included by Necker, which is typical *Trichomanes*, typified by *T. crispum*. The same rules which for the current decade validate Necker's publication of the genus thus make it an absolute synonym of *Trichomanes*.

As to *Lecanium* Reinwardt: Reinwardt in 1824 named a genus *Onychium*, typified by *O. carnosum*. His attention being called to the prior use of this name by Kaulfuss (1820), he immediately (Flora (1825) 3. Beilage, 48) suggested *Lecanium* as a substitute, and went on to suggest that *Lecanopteris* would be preferable, not being subject to confusion with *Lecanora*. The publication of both names, as synonyms, being thus avowedly tentative, both fall under Rule 40 of the Statutes of 1930. Blume (1828) validated *Lecanopteris*, as correctly shown by the citation in Christensen's Index; and *Lecanium* Reinwardt did not and does not legally exist.

[55] Page 76.

Fronds of more than one layer of parenchyma were first ascribed to this plant by Müller,[56] and this was agreed to by van den Bosch. As shown by Müller, by Mettenius,[57] and by Giesenhagen,[58] plural cell layers are not everywhere present. The adult plant[59] (Plate 10) is without roots, using metamorphosed shoots as substitutes.

Somewhat isolated in the foregoing respects, the genus is unique in its marginal scales, correctly described by Presl and figured by Müller, wrongly (as pelate) by Hooker,[60] inaccurately by Giesenhagen as spiral or snail-shaped, and most completely by Mettenius[61] and by Maxon,[62] "A pair of concave, cordate-orbicular, sessile, opposed, membranous squamules, these closely bordering the younger and smaller blades, deciduous in the larger ones." They are borne on the joint apices of two or more false veinlets, between each pair of true veinlets. They apparently serve (Giesenhagen) to hold water in the space they inclose, or eventually to maintain a measure of humidity about the thin and tender margin of the young fronds.

Range: The West Indies, and from Nicaragua to Bolivia and Venezuela.

30. Genus SELENODESMIUM Copeland gen. nov.

Trichomanes § *Selenodesmium* PRANTL, Hymen. (1873) 53.

Folia polysticha, lamina triangularis, petioli fasciculus sect. transv. semilunaris diarchus; paleae peltatae.—PRANTL, loc. cit.

Rhizomate valido, ad terram brevi-repente vel suberecto, stipitibus approximatis vel caespitosis, elongatis setis brevibus obscuris deciduis vestitis; frondibus basi acutis plus minus rigidis, pinnulis semidissectis parte mediale plerumque integra cum venis parallelis, venis deinde in segmenta monophlebia divergentibus: parietibus cellularum crassis conspicue vittatis, rarius undulatis; involucris cylindraceis ore haud bilabiato, receptaculo valde exserto.

A well-defined pantropic group of ill-defined species. The name probably refers to the "semilunar" cross section of the

[56] Bot. Zeit. 3 (1845) 577, pl. 4.
[57] Page 460, pl. 1, figs. 10, 11.
[58] Page 444, figs. 4, 8.
[59] Giesenhagen, 444, 445.
[60] Exotic Flora, pl. 76.
[61] Hymen. 469.
[62] Pterid. of Porto Rico, 498.

bundle of the stipe. *Trichomanes rigidum* Sw. is the type species, but the genus reaches its "more typical" development in the Malay-Polynesian region, where the remarkably thick and pitted walls and deltoid fronds are its best diagnostic characters. In America the fronds are less harsh and the walls more or less zigzag, as is true of young (and rare aberrant) Oriental specimens. The plants are strictly terrestrial and intolerant of desiccation. Stout proproots commonly support the stems of old plants above the surface of the ground. In spite of past confusion of the species, I see no evident affinity between this group and *Nesopteris*.

SPECIES OF SELENODESMIUM

SELENODESMIUM RIGIDUM (Sw.) Copeland comb. nov.

Trichomanes rigidum SWARTZ, Prod. (1788) 137.

Tropical America (JAMAICA).

SELENODESMIUM MANDIOCCANUM (Raddi) Copeland comb. nov.

Trichomanes mandioccanum RADDI, pl. Brasil. 1 (1825) 64.

BRAZIL; ? AFRICA.

SELENODESMIUM BATRACHOGLOSSUM Copeland.

Trichomanes batrachoglossum COPELAND, Trich. (1933) 244, pls. 50, 51, figs. 1, 2.

LIBERIA.

SELENODESMIUM CUPRESSOIDES (Desv.) Copeland comb. nov.

Trichomanes cupressoides DESVAUX, Prod. (1827) 330; COPELAND, Trich. (1933) 242, pl. 49.

East African Islands; ? AFRICA.

SELENODESMIUM STYLOSUM (Poir.) Copeland comb. nov.

Trichomanes stylosum POIRET, Lam. Enc. 8 (1808) 82; COPELAND, Trich. (1933) 243, pl. 51, figs. 3–5.

East African Islands.

SELENODESMIUM OBSCURUM (Blume) Copeland comb. nov.

Trichomanes obscurum BLUME, Enum. (1828) 227; VAN DEN BOSCH, Hymen. Javan. 23, pl. 17; COPELAND, Trich. (1933) 233, pls. 43, 44.

Java to India, Formosa, and Papua.

SELENODESMIUM EXTRAVAGANS Copeland.

Trichomanes extravagans COPELAND, Trich. (1933) 240, pl. 48.

LUZON.

SELENODESMIUM DENTATUM (v. d. B.) Copeland comb. nov.

Trichomanes dentatum VAN DEN BOSCH, Ned. Kruid. Arch. 51 (1861) 182; Journ. Bot. Neerl. 1 (1861) 363; COPELAND, Trich. (1933) 237, pls. 45, 46.

POLYNESIA.

SELENODESMIUM ELONGATUM (A. Cunn.) Copeland comb. nov.

Trichomanes elongatum A. CUNN., Comp. to Bot. Mag. 2 (1836) 368; HOOKER, Ic. Pl. pl. 701; COPELAND, Trich. (1933) 239, pl. 47, figs. 1, 2.

NEW ZEALAND; eastern Australia.

SELENODESMIUM LONGICOLLUM (v. d. B.) Copeland comb. nov.

Trichomanes longicollum VAN DEN BOSCH, Ann. Sc. Nat. IV 15 (1861) 90; COPELAND, Trich. (1933) 240, pl. 47, figs. 3–5.

NEW CALEDONIA.

31. Genus DAVALLIOPSIS van den Bosch

Davalliopsis VAN DEN BOSCH, Eerste Bijdrage (1861) 323.

Terrestris, rhizomate crasso adscendente, stipitibus caespitosis, elongatis, validis, sulcatis, fasciculis triangularibus; fronde egregie magna, tri-quadripinnatifida, basi acuta, lamina stratis tribus cellularum composita; involucro infundibuliforme ore expanso, receptaculo exserto.

Probably a single species, of tropical America.

DAVALLIOPSIS ELEGANS (Rich.) Copeland comb. nov. Plate 11.

Trichomanes elegans RICH., Act. Soc. Hist. Nat. Paris 1 (1792) 114.

Van den Bosch established this genus imperfectly, publishing no specific name under it; but his name fortunately was retained for subgeneric or section use by Prantl and Christensen.

The three-layered lamina [63] is the best diagnostic character of *Davalliopsis*. Such affinity as I see ground for suspecting is to *Selenodesmium;* but the wall structure of the latter is distinct, and the resemblance may be superficial.

Christensen says of *T. pachyphlebium* C. Chr. "Its nearest relative seems to be the American *T. elegans* Rich." [64] If it be indeed a *Davalliopsis,* it presents a case parallel to that of *Didymoglossum,* of possible Antarctic origin and escape by way of the Cape.

32. Genus MACROGLENA Copeland gen. nov.

Trichomanes, § *Macroglena* PRESL, Abh. böhm. Ges. Wiss. V 5 (1848) 333.

[63] Mettenius, pl. 4, figs. 1–4.

[64] Bonaparte, Notes Pterid. 12 (1920) 16, fig. 5; Pterid. Madag. 6.

Terrestres et epiphyticae, rhizomate valido, elongato vel breve, stipitibus remotis, confertis vel caespitosis; fronde majuscula pinnatim decomposita, axibus angustissime alatis segmentis deinde anguste linearibus vel setiformibus, rigidis; soris pantotactis, receptaculo cupuliforme vel rarius elongato, plerumque truncato nunquam bilabiato, receptaculo exserto.

Typus, M. meifolia (Bory sub Trichomane).

Range: Old World Tropics, south to New Zealand and Madagascar.

The extremely narrow (or eventually wanting) lamina, which is the conspicuous characteristic of this genus, is obviously not a primitive character, but may with confidence be regarded as the result of reduction. As has repeatedly to be noted, reduction is likely to result in similarity of plants of diverse ancestry. There are American species of *Vandenboschia* (*Leptomanes*) which are reduced in the same manner; these are distinguished from *Macroglena* by texture, and are not subject to confusion with it. But it may be that in the Orient or South, also, this kind of reduction has occurred in more than one line, and that thus I have been led to include here some species not nearly enough related to belong in one genus.

As I construe the genus, it includes *T. strictum* of New Zealand, and is old enough to be of direct Antarctic origin. I would rather believe that the Madagascar species are of Antarctic origin independent of *T. strictum;* and *T. angustatum* of Tristan d'Acunha, which I do not know, may survive as a third independent escape from Antarctica. Some species seem to be related to *Selenodesmium,* this being indicated by cell structure rather than by form of frond. I regard the two genera as cognate, rather than as derived one from the other.

Macroglena as a genus is unspecialized either as to the length of the rhizome or the structure of the cell walls—items usually characteristic of genera in this family. The type species has undifferentiated walls, but its stipes range from remote to congested.

SPECIES OF MACROGLENA

MACROGLENA MEIFOLIA (Bory) Copeland comb. nov.

Trichomanes meifolium Bory, Willdenow, Sp. Pl. 5 (1810) 509; Kaulfuss, Enum. 265, pl. 2; Christensen, Pterid. Madagascar (1932) 7, pl. 1, figs. 18–20; Copeland, Trich. (1933) 265.

Christensen regards this species as confined to Madagascar and Réunion. As I construe it, more broadly, including *T. Pluma* Hooker, it ranges also from Malaya to Samoa.

MACROGLENA PARVIFLORA (Poiret) Copeland comb. nov.

Trichomanes parviflorum Poiret, LAMARCK, Enc. 8 (1808) 83; CHRISTENSEN, Pterid. Madag. (1932) 7, pl. 1, figs. 10–13.

MASCARENES; farther range, to Polynesia, in doubt.

MACROGLENA ANGUSTIMARGINATA (Bonaparte) Copeland comb. nov.

Trichomanes angustimarginatum BONAPARTE, Notes Pterid. 16 (1925) 12; CHRISTENSEN, Pterid. Madag. (1932) 7, pl. 1, figs. 14–17.

MADAGASCAR.

MACROGLENA GEMMATA (J. Sm.) Copeland comb. nov.

Trichomanes gemmatum J. SM., Hooker's Journ. Bot. 3 (1841) 417; BAKER, Syn. Fil. (1867) 87; COPELAND, Trich. (1933) 269, pl. 61, fig. 2.

MALAY PENINSULA; BORNEO.

MACROGLENA SETACEA (v. d. B.) Copeland comb. nov.

Trichomanes setaceum VAN DEN BOSCH, Ned. Kr. Arch. 5 [2] (1861) 176; COPELAND, Trich. (1933) 260, pl. 57, fig. 1.

MALAY PENINSULA; BORNEO; PHILIPPINES.

MACROGLENA COMPACTA (v. A. v. R.) Copeland comb. nov.

Trichomanes compactum v. A. v. ROSENBURGH, Nova Guinea 14 (1924) 57; COPELAND, Trich. (1933) 265, pl. 49.

NEW GUINEA.

MACROGLENA ASAE-GRAYI (v. d. B.) Copeland comb. nov.

Trichomanes Asae-Grayi VAN DEN BOSCH, Ned. Kr. Arch. 5 [2] (1861) 180; COPELAND, Trich. (1933) 264, pl. 61, fig. 1.

FIJI; SAMOA; TAHITI.

MACROGLENA FLAVO-FUSCA (v. d. B.) Copeland comb. nov.

Trichomanes flavo-fuscum VAN DEN BOSCH, Ann. Sc. Nat. IV 15 (1861) 88; COPELAND, Trich. (1933) 264, pl. 58, fig. 2.

NEW CALEDONIA.

MACROGLENA SCHLECHTERI (Brause) Copeland comb. nov.

Trichomanes Schlechteri BRAUSE, Bot. Jahrb. 49 (1912) 10; COPELAND, Trich. (1933) 268, pl. 60.

NEW GUINEA.

MACROGLENA LAETA (v. d. B.) Copeland comb. nov.

Trichomanes laetum VAN DEN BOSCH, Ann. Sc. Nat. IV 15 (1861) 90; COPELAND, Trich. (1933) 261, pl. 57, fig. 2.

NEW CALEDONIA.

MACROGLENA CAUDATA (Brack.) Copeland comb. nov.

Trichomanes caudatum BRACKENRIDGE, U. S. Expl. Exped. 16 (1854) 256, pl. 36, fig. 5; COPELAND, Trich. (1933) 262, pl. 57, figs. 3–5; pl. 58, fig. 1.

Tahiti to Queensland.

MACROGLENA STRICTA (Menzies) Copeland comb. nov.

Trichomanes strictum MENZIES, Hooker and Greville, Ic. Fil. (1831) pl. 122; COPELAND, Trich. (1933) 259, pl. 56, figs. 3, 4.

NEW ZEALAND.

33. Genus ABRODICTYUM Presl

Abrodictyum PRESL, Hymen. (1843) 112, pl. 7.

Epiphyticum ad truncos filicum, rhizomate breve, parvo, stipitibus dense caespitosis, basi setosis, teretibus; fronde mediocre bipinnatifida vel subtripinnatifida anguste elliptica, pendente, segmentis linearibus; cellulis (marginalibus exceptis) transversim elongatis, et oblique longitudinaliter instructis, parietibus conspicue vittatis; involucro infundibuliforme limbo patente receptaculo setaceo valde elongato.

A single species, without particular evident affinity, common on tree-fern trunks in the Philippines, and reported from Celebes (Kjellberg and Christensen) and the Moluccas (van den Bosch).

Van den Bosch altered the name to *Habrodictyon.*

SPECIES OF ABRODICTYUM

ABRODICTYUM CUMINGII Presl.

A large majority of the species of the Hymenophyllaceæ are found in the moist Tropics. In this sense only, the statement of Sadebeck, is correct: "Das Centrum der geographischen Verbreitung ist in den Tropen." [65] The origin of the family, as it now exists, was Austral. Sadebeck notes that New Zealand is "fast ein zweites Centrum"; and both he and Christ, as others before them, note the wealth of these plants in Antarctic America. But these conditions seem to have been interpreted as evidence that ferns of tropic origin find there a sufficiently uniform humidity and temperature. Like the Gleicheniaceæ and *Blechnum,* as to both of which Diels notes how far south they "vordringen," the Hymenophyllaceæ present most perfect geographic evidence of Antarctic origin, and of migration into, not from, the Tropics.

The Hymenophyllaceæ constitute about one fourteenth of the world's fern species, and this proportion may rise to about one in twelve in the Tropics. This is the closest whole number for Borneo and Java. Eastward migration from the Malay

[65] Nat. Pflanzenfamilien. Teil I Abt. 4 (1902) 104.

region is always assumed to be responsible for the bulk of the fern population of Polynesia. In Fiji and the Society Islands the proportion of Hymenophyllaceæ rises slightly, to one in ten. Diversion of this migration to the northeast extended it to Hawaii; to the southeast (if it occurred), to New Zealand. This is the process pictured by "vordringen," and if the picture were correct, the composition of the fern floras of Hawaii and New Zealand should correspond reasonably to that of Malaya, for the climatic conditions of both permit the filmy ferns to thrive. Actually, they are one in eighteen of all Hawaiian [66] ferns and one in five in New Zealand. Going south in New Zealand, the proportion continues to rise, reaching one in three in the Stewart Islands.[67] Ten species of *Hymenophyllum* are reported (Cockayne, Holloway) even from the Auckland Islands, beyond 50° south latitude. In the Northern Hemisphere the climate of the wet side of southern New Zealand is duplicated, at the same latitude, from Portland to Sitka, but Hymenophyllaceæ are totally absent.

In far southern America, in the narrow strip west of the Andes, the climatic conditions of New Zealand are sufficiently duplicated, and there is a similar wealth of species of filmy ferns, although few species are common to New Zealand.[68] As this area, being continental, can be given only an arbitrary northern limit, I have not tried to determine the proportion of Hymenophyllaceæ to all ferns; but it will correspond roughly to southern New Zealand. Juan Fernandez is an outlying fragment of this region, and its Hymenophyllaceæ (Christensen and Skottsberg, 1920), are fifteen out of forty-nine ferns, not quite one in three. In the Falkland Islands they seem to be three out of five.

[66] The Hawaiian climate, as a whole, is less appropriate to these ferns than that of New Zealand, but there are sufficient areas that are perfectly suitable. Hawaiian Polypodiaceæ, as a whole, are obviously of Malayan origin. Of the eight Hymenophyllaceæ, only *Gonocormus minutus* and *Callistopteris Baldwinii* suggest possible Malayan origin; the others are endemic: *Vandenboschia davallioides* and *V. cyrtotheca*, apparently American in affinity; *V. draytoniana* and *Mecodium recurvum*, far southern; and two species of *Sphaerocionium*, Antarctic (New Zealand) rather than anything else.

[67] Holloway, Trans. N. Z. Inst. 55 (1924) 84.

[68] The exact number is a question of specific identity. *Hymenophyllum tunbridgense*, *H. peltatum*, and *Sphaerocionium aeruginosum* are represented by forms which have been regarded as specifically identical.

South Africa seems never to have been as near to Antarctica as New Zealand and America have been, and its present climate would not permit a rich hymenophyllaceous flora, if it ever had one. *Mecodium rarum, H. tunbridgense,* and *H. peltatum* are represented by identical, or very similar plants in New Zealand and South Africa. *Sphaerocionium Lyallii* and *S. Marlothii* are nearly related. *Didymoglossum Robinsonii,* first described under this specific name from Natal, is the most southern representative of its genus. If, by analogy with other genera, we impute direct Antarctic origin to *Didymoglossum,* it is the only genus (except, possibly, *Davalliopsis*) that seems to have escaped from Antarctica by this route only; and this will explain its unique present range—America, Africa, and eastward only as far as Ceylon. Nothing in the family in South Africa seems, with much probability, to have had a northern origin. Because of the paucity of species, this rather negative statement is all that is possible. The comparative absence of immigrants from Antarctica must be responsible for the paucity of the family in all Africa and its islands.[69] According to Kuhn's old figures the proportion to all ferns is one in eighteen. Even this low proportion is reached by including St. Helena and Tristan d'Acunha which may well have received their filmy ferns directly from Antarctica.

The inability of tropical Hymenophyllaceæ to migrate from the Tropics is attested by their paucity in the North—five species in the United States (three of which reach only to southern Florida), and three in Europe. The Japan region has more, but not nearly as many as have been described. This must be a recent element in the Japanese flora, or it should have reached America when the North Pacific climate was more favorable.

The diversity of far southern Hymenophyllaceæ presents evidence of Antarctic origin as conclusive as that of wealth of species. In the first place, every genus common to America and Malaya, unless it be *Microgonium,* occurs in New Zealand, and all others except *Selenodesmium* in South Chile. As to *Microgonium,* it is doubtful whether its one American species, *M. Hookeri,* really belongs in the genus. With the genera *Hymenophyllum, Meringium, Mecodium, Sphaerocionium, Vandenboschia,* and *Selenodesmium,* New Zealand has also *Crepidopteris*

[69] Fil. Africa (1868).

of wide range. I cannot now authenticate the statement in my treatise on Trichomanes,[70] that *T. bipunctatum*, a *Crepidomanes*, is in New Zealand; it is common in southern Polynesia, and thence in Madagascar. Besides these large genera, New Zealand has *Cardiomanes*, altogether isolated, *Polyphlebium*, related to *Vandenboschia*, and *Apteropteris*, probably derived from *Sphaerocionium*. *Diploophyllum* (with another name) may be added to this list if one choose to recognize it as a genus.

Antarctic America is still richer in peculiar species and genera. With its outlying islands it has *Serpyllopsis*, which has been referred to both *Trichomanes* and *Hymenophyllum*. *Hymenoglossum* is as isolated as *Cardiomanes*. *Leptocionium* shares the characteristics of *Meringium* and *Sphaerocionium*.

There survive then at least six genera restricted to the far South. Of the genera which either never were there or do not survive there, only *Didymoglossum* and *Microgonium* are on both sides of the Atlantic. *Didymoglossum* has a representative in Natal, which suggests Antarctic origin; it does not reach Malaya and Polynesia. *Microgonium* is doubtfully in America.

The genera which do not occur in the far South can be derived from those which survive there, in each hemisphere, locally, from the local representatives of the originally Antarctic genera, with the single possible exception of *Abrodictyum*, which may be derived from *Selenodesmium*, but is more isolated than any other tropical genus. With this single possible exception, then, the entire family consists of genera surviving in the far South, or of the descendants of these genera. The geographic evidence is conclusive.

Evidence that Antarctica could have been the source of the family still remains to be presented, since the Antarctic continent is not now a place where any fern survives. There is not much palæontological evidence on the subject, but two quotations may suffice as to the general fact. In the Glaciology of Wright and Priestly, a volume of the report of the British Antarctic Expedition, it is stated in italics: "Glacial conditions have been the exception and not the rule in Antarctica."[71] And "In the upper Oligocene or lower Miocene, once more a temperate to subtropical flora holds sway over some portion of the Antarctic Continent."[72] No approximately complete land con-

[70] Page 177. [71] (1922) 44. [72] Op. cit., 446.

nection is necessary for the dispersal of these plants. In the absence of fossils, the evidence of suitable climate is all that can be expected. If the Hymenophyllaceæ of today are the descendants of Oligocene migrants from Antarctica, the elapsed time must have sufficed, by its length, for their present dispersal and diversification; and, by its shortness, to account for their limited northern dispersal, and for the absence elsewhere of such very divergent or generalized (*Serpyllopsis*) genera as are found in the far South.

The pantropic genera are *Mecodium, Sphaerocionium, Hymenophyllum, Meringium, Vandenboschia,* and *Selenodesmium,* with which *Didymoglossum* may be included, although wanting in the far eastern region. These are all found now in the far South, where their surviving species are traces of the path of their migration to the Tropics. They were evidently differentiated as genera in Antarctica, and this cannot have occurred later than early Miocene. It may have been earlier, but not indefinitely earlier.

During the warm era which ended in the Miocene, these genera presumably became differentiated and were able to emigrate. The change at the end of that era did not drive them out, except as possibly subantarctic land became habitable under the influence of the Antarctic refrigeration. Directly, the Antarctic cold merely exterminated whatever was there, very likely including older, more primitive forms which, if they had survived would let us construct the trunk of the hymenophyllaceous genealogical tree, of which we now have only these main branches, some comparatively abortive branches represented by the small genera of the far South, and the more recent branches (of the main branches), represented by the tropical genera of limited distribution.

The still earlier history of the family is more a matter of speculation, unsupported, I suspect, by any fossil evidence whatever. Its locus may have been Antarctica from the time the phylum became identifiable. That there is no living representative which is unlikely to have had an Antarctic ancestor, creates a presumption against an original differentiation of the family in some other region.

Of course, the family had ancestors. These are homosporous leptosporangiate ferns, of the same general evolutionary status as Gleicheniaceæ and Schizaeaceœ, newer and "higher" than Osmundaceæ, less perfectly evolved so far as the charac-

ters of the family as a whole are concerned than the Polypodiaceæ, and probably older than most of the polypodiaceous genera.

The general structural simplicity of the fronds, reminiscent of the mosses, was once responsible for the opinion that the Hymenophyllaceæ were related to the mosses and were the most primitive ferns. The last exponent of this view was Prantl, who held it after it ceased to be reasonable. It is more curious and less reasonable to find Goebel supporting the same opinion as to the gametophyte, even in recent years. The protonema of "*Trichomanes*" is more like that of mosses than is the corresponding structure of "*Hymenophyllum,*" and he regards the branched, nonthalloid protonema as the phylogenetically oldest form of the hymenophyllaceous prothallium. However complete the apparent identity of the protonema of "*Trichomanes*" and a moss, it is not evidence of affinity unless the gametophyte has an ancestry distinct from that of the sporophyte, and to a group, the Musci, far aside from the accepted line of fern evolution. The protonema is the least primitive gametophyte in the family, just as the minute fronds of *Microgonium,* which Prantl regarded as the most primitive sporophytes, are really the least so.

The Hymenophyllaceæ had fern ancestors. Their evolution as a family was a phenomenon of reduction, on a scale for which there is no parallel among independent (holophytic) vascular plants. On the scale of one small genus we know similar reduction of the leaf tissue in *Leptopteris.* On the scale of one tissue we know aquatics which have lost their stomata. But no other considerable family has lost the tissue differentiation of the plant leaf. And this is a fairly successful family, judged by the area it occupies, and by its wealth of genera and species and individuals. It evidently fits well a set of conditions—high humidity, weak illumination, still air—common, especially in the Tropics. Except as man may destroy its environment by removing the forest, it is not at all a waning family. Its prosperity, with its simplified leaves, throws instructive light on the conditions responsible for the evolution of the ordinary leaf and its tissues.

Within the family reduction continues to be the most interesting phenomenon of general evolution. *Craspedophyllum, Microtrichomanes, Didymoglossum,* and *Microgonium* are genera in whose evolution reduction in size, correlated with inevitable simplification in form, has been the most conspicuous element. Without transgressing the generic limits I recognize, reduction

of the same kind has been conspicuous in *Mecodium, Sphaerocionium, Meringium, Cephalomanes, Didymoglossum, Microtrichomanes,* and *Vandenboschia.* Very many species are exceedingly plastic in the same respect, a fact responsible for a very large number of sure synonyms, and for the difficulty of assigning limits to such species as *Vandenboschia radicans, Mecodium polyanthos,* all common species of *Crepidomanes,* and most species of *Gonocormus* and *Selenodesmium.*

The proposal of more than thirty genera, in a family where two have been imagined to suffice, will not be welcomed by those insufficiently acquainted with these plants to understand the propriety of any larger number. Really, there are very few of the thirty-three as to the propriety of which I recognize any question. *Hemicyatheon* and *Amphipterum* are maintained because any other course, conserving naturalness, involves worse inconvenience. *Apteropteris* and *Myriodon* are proposed because the plants are too bizarre to go well into the large genera to which they are related; each is in its way unique among vascular plants. *Meringium* could have been left in *Hymenophyllum;* but the separation seems natural, facilitates the picturing of their dispersal and subsequent evolution, and leaves both genera large enough for convenience.

One can easily go farther in the recognition of genera. My predecessors have divided *Trichomanes* and *Feea* more finely, and it will probably be done again. *Microgonium Hookeri* may belong in a genus by itself. *Trichomanes Hildebrandtii* and *Hymenophyllum Levingei,* both unknown to me, are described as peculiar enough perhaps to merit generic status. And a number of far southern species which I include in the cosmopolitan genera are at least very foreign elements there. Thus *Hymenophyllum pectinatum* may become a monotypic genus. *Diploophyllum* may again be separated from *Mecodium.* And *Hymenophyllum dentatum* is so far from at home in *Meringium* that I abstain from renaming it there, though it belongs nowhere else. *Hymenophyllum Rolandi-Principis* is a generic entity, but may better remain unnamed as such until its fruit may be discovered.

In each of the thirty-three adopted and named genera I have listed the species I know to belong there and believe to be good species. As to the Old World species this listing is almost complete. As a matter of convenience I conclude this treatise with an index of synonyms of *Trichomanes* and *Hyme-*

nophyllum, based on Christensen's Index Filicum and its supplements, and intended for use in connection therewith. In this index will be found many such entries as *Vandenboschia* sp., *Mecodium* sp., and *Sphaerocionium* sp. In such cases I abstain from a transfer of specific name because I do not personally know the species in question and, therefore, have no judgment as to the validity of the species, not because of doubt as to its genus. Experience with Oriental named species has shown a surprising proportion which seem to me not to be distinct, and this makes me fear that a general transfer of published names of American species would result in many undesirable synonyms.

INDEX OF SYNONYMS

HYMENOPHYLLUM

H. abruptum Hooker.	*Mecodium abruptum.*
H. acanthoides Ros.	*Meringium acanthoides.*
H. acrosorum v. d. B.	*Mecodium polyanthos.*
H. aculeatum Racib.	*Meringium denticulatum.*
H. aculeolatum v. d. B.	*Meringium* ?
H. adiantoides v. d. B.	*Sphaerocionium* sp.
H. aeruginosum Carm.	*Sphaerocionium* sp.
H. affine Brack.	id.
H. Alfredii Ros.	*Mecodium Alfredii.*
H. alpinum Col.	*Meringium multifidum.*
H. alveolatum C. Chr.	id.
H. amabile Morton.	*Sphaerocionium* sp.
H. andinum v. d. B.	*Mecodium andinum.*
H. angulosum Christ.	*Mecodium angulosum.*
H. angustifrons Christ.	*Sphaerocionium* sp.
H. angustum v. d. B.	*Sphaerocionium* sp.
H. anisopterum A. Peter.	*Sphaerocionium* sp.
H. antarcticum Presl.	id.
H. antillense Jenman.	*Sphaerocionium antillense.*
H. apiculatum Mett.	*Mecodium* sp.
H. Armstrongii Kirk.	*Microtrichomanes* ?
H. asperulum Kze.	id.
H. asplenioides Sw.	*Mecodium asplenioides.*
H. atrovirens Col.	*Mecodium australe* ?
H. australe Willd.	*Mecodium australe.*
H. axillare Sw.	*Mecodium axillare.*
H. Babindae Watts.	*Hymenophyllum antarcticum.*
H. badium H. and G.	*Mecodium badium.*
H. Balansae Fourn.	*Mecodium* sp.
H. baileyanum Domin.	*Hemicyatheon Baileyanum.*
H. Bakeri Copel.	*Meringium Bakeri.*
H. Baldwinii Eaton.	*Callistopteris Baldwinii.*
H. Balfourii Baker.	*Mecodium fumarioides.*

H. bamlerianum Ros.	*Mecodium imbricatum.*
H. barbatum Baker.	id.
H. batuense Ros.	*Meringium* sp.
H. bicolanum Copel.	*Meringium bicolanum.*
H. bismarckianum Christ.	*Mecodium* sp.
H. bivalve Sw.	*Meringium bivalve.*
H. blandum Racib.	*Meringium blandum.*
H. blumianum Spr.	*Mecodium polyanthos.*
H. bontocense Copel.	*Meringium bontocense.*
H. borneense Hooker.	*Microtrichomanes palmatifidum.*
H. Boschii Ros.	*Meringium holochilum.*
H. botryoides v. d. B.	*Mecodium* sp.
H. Boutonii Baker.	*Sphaerocionium* sp.
H. brachyglossum A. Br.	*Meringium brachyglossum.*
H. brachypus Sod.	id.
H. brasilianum Ros.	*Sphaerocionium* sp.
H. breve Ros.	*Mecodium* sp.
H. brevidens v. A. v. R.	*Meringium* sp.
H. brevistipes Liebm.	*Mecodium* sp.
H. Buchtienii Ros.	*Sphaerocionium Buchtienii.*
H. caespitosum Gaud.	*Serphyllopsis caespitosa.*
H. calodictyon v. d. B.	*Meringium* ?
H. campanulatum Christ.	*Meringium campanulatum.*
H. capillaceum Roxb.	*Mecodium* sp.
H. capillare Desv.	*Sphaerocionium capillare.*
H. Cardunculus C. Chr.	*Meringium Cardunculus.*
H. carnosum Christ.	*Mecodium* sp.
H. caudatellum Christ.	*Sphaerocionium* sp.
H. caudiculatum Mart.	*Mecodium caudiculatum.*
H. ceratophylloides Christ.	id. (?)
H. cernuum Gepp.	*Amphipterum* sp.
H. Cheesemani Baker.	*Microtrichomanes* ?
H. Chrysothrix Sturm.	*Sphaerocionium* sp.
H. ciliatum Sw.	*Sphaerocionium ciliatum.*
H. cincinnatum Gepp.	*Meringium* sp.
H. Clemensiae Copel.	*Meringium pachydermicum.*
H. compactum Bonap.	*Mecodium fumarioides.*
H. constrictum Christ.	*Mecodium constrictum.*
H. constrictum Hayata.	*Mecodium polyanthos.*
H. contextum Ros.	*Mecodium contextum.*
H. contortum v. d. B.	*Mecodium contortum.*
H. contractile Sod.	*Sphaerocionium* sp.
H. copelandianum v. A. v. R.	*Mecodium Reinwardtii.*
H. coreanum Nakai.	*Mecodium Wrightii.*
H. corrugatum Christ.	*Mecodium corrugatum.*
H. corticola Hooker.	*Microtrichomanes nitidulum.*
H. costaricanum v. d. B.	*Mecodium costaricanum.*
H. crispato-alatum Hayata.	*Mecodium crispato-alatum.*
H. crispatulum v. d. B.	*Spaerocionium* sp.

H. crispatum Wall.	*Mecodium crispatum.*
H. crispum H. B. K.	*Sphaerocionium* sp.
H. cristulatum Ros.	*Mecodium sanguinolentum.*
H. Cruegeri Müller.	*Sphaerocionium Cruegeri.*
H. cruentum Cav.	*Hymenoglossum cruentum.*
H. cubense Sturm.	*Sphaerocionium* sp.
H. cuneatum Kze.	*Mecodium cuneatum.*
H. cupressiforme Lab.	id.
H. Darwinii Hk. f.	*Mecodium* sp.
H. decurrens Sw.	*Sphaerocionium* sp.
H. dejectum Baker.	*Hymenophyllopsis dejecta.*
H. Delavayi Christ.	*Mecodium exsertum.*
H. delicatissimum Fée.	*Sphaerocionium Cruegeri.*
H. deltoideum C. Chr.	*Mecodium Humbertii.*
H. demissum Sw.	*Mecodium demissum.*
H. Dendritis Ros.	*Mecodium Dendritis.*
H. densifolium Phil.	*Serpyllopsis caespitosa.*
H. dentatum Cav.	*Meringium* ?
H. denticulatum Sw.	*Meringium denticulatum.*
H. Deplanchei Mett.	*Hemicyatheon Deplanchei.*
H. dichotomum Blume.	*Mecodium Reinwardtii.*
H. dichotomum Cav.	*Meringium denticulatum.*
H. dichotomum aliorum.	*Merigium plicatum.*
H. dicranotrichum.	*Leptocionium dicranotrichum.*
H. dilatatum Sw.	*Mecodium dilatatum.*
H. dimidiatum Mett.	*Meringium dimidiatum.*
H. dimorphum Christ.	*Sphaerocionium* sp.
H. dipteroneuron A. Br.	*Amphipterum fuscum.*
H. discosum Christ.	*Mecodium paniculiflorum.*
H. divaricatum v. d. B.	*Sphaerocionium* sp.
H. Durandii Christ.	*Sphaerocionium Durandii.*
H. Dusenii Christ.	*Serpyllopsis caespitosa.*
H. ectocarpon Fée.	?
H. edentulum C. Chr.	*Meringium edentulum.*
H. Elberti Ros.	*Meringium* sp.
H. elegans Spr.	*Sphaerocionium elegans.*
H. elegantissimum Fée.	*Sphaerocionium elegantissimum.*
H. elegantulum v. d. B.	*Sphaerocionium elegantulum.*
H. ellipticosorum v. A. v. R.	*Meringium* sp.
H. emarginatum Sw.	*Mecodium emarginatum.*
H. epiphyticum J. W. Moore.	*Mecodium polyanthos.*
H. erosum Blume.	*Mecodium javanicum.*
H. exiguum Bedd.	*Didymoglossum exiguum.*
H. eximium Kunze.	*Mecodium emarginatum.*
H. exsertum Wall.	*Mecodium exsertum.*
H. falklandicum Baker.	id.
H. farallonense Hieron.	*Mecodium* sp.
H. fastigiosum Christ.	*Hymenophyllum barbatum.*
H. fecundum v. d. B.	*Mecodium* sp.
H. feejeense Brack.	*Meringium feejeense.*

H. fendlerianum Sturm.	*Mecodium fendlerianum.*
H. ferax v. d. B.	*Mecodium ferax.*
H. ferrugineum Colla.	*Sphaerocionium ferrugineum.*
H. Filicula Bory.	*Crepidomanes bipunctatum.*
H. fimbriatum J. Sm.	*Mecodium fimbriatum.*
H. firmum v. A. v. R.	*Meringium firmum.*
H. flabellatum Lab.	*Mecodium flabellatum.*
H. flexile Makino.	*Mecodium flexile.*
H. flexuosum A. Cunn.	*Mecodium flexuosum.*
H. Foersteri Ros.	*Meringium* ?
H. formosum Brack.	*Mecodium imbricatum.*
H. Foxworthyi Copel.	*Pleuromanes pallidum.*
H. Francavillei v. d. B.	*Sphaerocionium* sp.
H. Franklinіae Col.	*Sphaerocionium ferrugineum.*
H. fraternum Harr.	*Mecodium fimbriatum.*
H. fuciforme Sw.	*Mecodium* ? (receptacle elongate.)
H. fucoides Sw.	*Meringium fucoides.*
H. Fuertesii Brause.	*Sphaerocionium* sp.
H. fujisanense Nakai.	*Mecodium polyanthos.*
H. fumarioides Willd.	*Mecodium fumarioides.*
H. Funckii v. d. B.	*Mecodium* sp.
H. fuscum v. d. B.	*Amphipterum fuscum.*
H. fusugasugense Karst.	*Sphaerocionium* sp.
H. Gardneri v. d. B.	*Mecodium exsertum.*
H. geluense Ros.	*Amphipterum geluense.*
H. Glaziovii Baker.	*Sphaerocionium* sp.
H. glebarium Christ.	?
H. Gollmeri v. d. B.	*Mecodium* sp.
H. gorgoneum Copel.	*Meringium gorgoneum.*
H. gracilescens Domin.	id.
H. gracilius Copel.	*Mecodium polyanthos.*
H. gratum Fée.	?
H. halconense Copel.	*Meringium pachydermicum.*
H. Hallieri Ros.	*Meringium* sp.
H. hamuliferum v. A. v. R.	*Meringium holochilum.*
H. helicoideum Sod.	*Mecodium* sp.
H. hemipteron Ros.	*Sphaerocionium hemipteron.*
H. Henryi Baker.	*Hymenophyllum barbatum.*
H. hertericanum Brause.	*Meringium* ?
H. Herzogii Ros.	id.
H. Hieronymi C. Chr.	*Meringium* sp.
H. himalaianum v. d. B.	*Mecodium polyanthos.*
H. hirsutum Sw.	*Sphaerocionium hirsutum.*
H. hirtellum Sw.	*Sphaerocionium hirtellum.*
H. holochilum C. Chr.	*Meringium holochilum.*
H. holotrichum A. Peter.	*Sphaerocionium* sp.
H. Hosei Copel.	*Meringium Hosei.*
H. Houstonii Jenman.	id. (?) (sterile.)
H. Humbertii C. Chr.	*Mecodium Humbertii.*
H. humboldtianum Fourn.	*Mecodium* sp.

H. hygrometricum Desv.	*Sphaerocionum hygrometricum.*
H. imbricatum Blume.	*Mecodium imbricatum.*
H. inaequale Desv.	*Mecodium inaequale.*
H. integrum v. d. B.	*Mecodium polyanthos.*
H. intercalatum Christ.	*Sphaerocionium* sp.
H. interruptum Kze.	*Sphaerocionium interruptum.*
H. intricatum v. d. B.	*Mecodium intricatum.*
H. involucratum Copel.	*Mecodium involucratum.*
H. Jamesoni Hooker.	*Buesia Jamesoni.*
H. japonicum Miq.	*Hymenophyllum barbatum.*
H. javanicum Spr.	*Mecodium javanicum.*
H. johorense Holttum.	*Microtrichomanes johorense.*
H. Junghuhnii v. d. B.	*Mecodium Junghuhnii.*
H. kaieteurum Jenman.	?
H. karstenianum Sturm.	*Sphaerocionium* sp.
H. kerianum Watts.	*Meringium kerianum.*
H. khasianum Baker.	*Hymenophyllum barbatum.*
H. klabatense Christ.	*Meringium klabatense.*
H. kohautianum Presl.	*Mecodium* sp.
H. Kuhnii C. Chr.	*Mecodium Kuhnii.*
H. Kurzii Prantl.	*Meringium holochilum.*
H. laciniosum Christ.	*Mecodium nigricans.*
H. laminatum Copel.	*Amphipterum laminatum.*
H. lanatum Fée.	*Sphaerocionium lanatum.*
H. lanceolatum H. and A.	*Sphaerocionium lanceolatum.*
H. latilobum Bonap.	*Mecodium badium.*
H. Ledermanni Brause.	*Amphipterum Ledermanni.*
H. Lehmanni Hieron.	*Mecodium* sp.
H. leptocarpum Copel.	*Meringium penangianum.*
H. leptodictyon K. Müller.	*Mecodium emarginatum.*
H. LeRatii Ros.	*Mecodium LeRatii.*
H. Levingei Clarke.	id. ?
H. L'Herminieri Mett.	*Mecodium* sp.
H. Limminghii v. d. B.	*Mecodium fumarioides.*
H. Lindeni Hooker.	*Sphaerocionium* sp.
H. Lindigii Mett.	*Sphaerocionium* sp.
H. lindsaeoides Baker.	*Sphenomeris odontolabia.*
H. linearc Sw.	*Sphaerocionium lineare.*
H. lingganum v. A. v. R.	*Meringium holochilum.*
H. Lobbii Moore.	*Meringium Lobbii.*
H. longifolium v. A. v. R.	*Mecodium longifolium.*
H. lophocarpum Col.	*Mecodium sanguinolentum.*
H. Lyallii Hooker f.	*Sphaerocionium Lyallii.*
H. Macgillivrayi Copel.	*Meringium Macgillivrayi.*
H. macrocarpum v. d. B.	*Mecodium badium.*
H. macroglossum v. d. B.	*Meringium macroglossum.*
H. macrosorum v. A. v. R.	*Meringium macrosorum.*
H. macrothecum Fée.	*Mecodium macrothecum.*
H. magellanicum Willd.	*Meringium magellanicum.*
H. Malingii Mett.	*Apteropteris Malingii.*

H. marginatum H. and G.	*Craspedophyllum marginatum.*
H. Marlothii Brause.	*Sphaerocionium Marlothii.*
H. Mazei Fourn.	*Mecodium* sp.
H. megalocarpum Col.	*Mecodium demissum.*
H. melanocheilos Col.	*Microtrichomanes* (?) *Armstrongii.*
H. Merrillii Christ.	*Meringium Merrillii.*
H. meyenianum Copel.	*Meringium meyenianum.*
H. micans Christ.	*Mecodium* sp.
H. micranthum v. d. B.	*Mecodium javanicum.*
H. microcarpum Desv.	*Sphaerocionium microcarpum.*
H. microchilum C. Chr.	*Mecodium polyanthos.*
H. microphyllum Mett.	*Mecodium* sp.
M. microsorum v. d. B.	*Mecodium polyanthos.*
H. millefolium Schl. and Cham.	*Mecodium* sp. (*polyanthos* ?)
H. minimum A. Rich.	id. ?
H. mirificum Morton.	*Buesia mirifica.*
H. mnioides Baker.	*Mecodium mnioides.*
H. modestum v. d. B.	*Mecodium emarginatum.*
H. montanum Kirk.	*Mecodium montanum.*
H. Moorei Baker.	*Hymenophyllum pumilum.*
H. multifidum Sw.	*Meringium multifidum.*
H. multiflorum Ros.	*Mecodium multiflorum.*
H. myriocarpum Hooker.	*Mecodium myriocarpum.*
H. nanum Sod.	id.
H. Neesii Hooker.	*Meringium denticulatum.*
H. nigrescens Liebm.	*Mecodium nigricans.*
H. nitens R. Br.	*Mecodium flabellatum.*
H. nitiduloides Copel.	*Mecodium nitiduloides.*
H. notabile Fée.	?
H. nutantifolium v. A. v. R.	*Meringium* sp.
H. obtusum H. and A.	*Sphaerocionium obtusum.*
H. odontophyllum Copel.	*Myriodon odontophyllus.*
H. oligocarpum Col.	*Meringium multifidum.*
H. oligosorum Makino.	*Mecodium Wrightii.*
H. omeiense Christ.	*Hymenophyllum barbatum.*
H. ooides Müller and Baker.	*Mecodium ooides.*
H. opacum Copel.	*Mecodium opacum.*
H. orbignyanum v. d. B.	*Sphaerocionium* sp.
H. osmundoides v. d. B.	*Mecodium polyanthos.*
H. ovatum Copel.	*Meringium ovatum.*
H. oxyodon Baker.	*Hymenophyllum barbatum.*
H. pachydermicum Cesati.	*Meringium pachydermicum.*
H. palmatum v. d. B.	*Microtrichomanes parvulum.*
H. palmense Ros.	*Sphaerocionium palmense.*
H. paniculiflorum Presl.	*Mecodium paniculiflorum.*
H. pannosum Christ.	*Sphaerocionium* sp.
H. pantotactum v. A. v. R.	*Mecodium polyanthos.*
H. parvifolium Baker.	*Microgonium* sp.
H. parallelocarpum Hayata.	*Mecodium polyanthos.*
H. parvulum C. Chr.	*Mecodium* sp.

H. parvum C. Chr.	*Mecodium fumarioides.*
H. paucicarpum Jenman.	*Mecodium* (*teste* Morton.)
H. pectinatum Cav.	id.
H. pedicularifolium Cesati.	*Meringium* sp.
H. peltatum Desv.	id.
H. penangianum Matthew and Christ.	*Meringium penangianum.*
H. pendulum Bory.	*Sphaerocionium capillare.*
H. perfissum Copel.	id.
H. perparvulum v. A. v. R.	*Meringium* sp.
H. physocarpum Christ.	*Mecodium thuidium.*
H. piliferum C. Chr.	?
H. pilosissimum C. Chr.	*Sphaerocionium pilosissimum.*
H. pilosum v. A. v. R.	*Meringium pachydermicum.*
H. pleiocarpum v. A. v. R.	*Mecodium crispatum.*
H. plicatum Kaulf.	*Meringium plicatum.*
H. plumosum Kaulf.	*Sphaerocionium plumosum.*
H. Poilanei Tard. and C. Chr.	id. (?)
H. pollenianum Ros.	*Meringium pollenianum.*
H. polyanthos Sw.	*Mecodium polyanthos.*
H. polyanthum Hooker.	*Callistopteris polyantha.*
H. polychilum Col.	*Mecodium demissum.*
H. polyodon Baker.	id. (?)
H. Poolii Baker.	*Sphaerocionium Poolii.*
H. praetervisum Christ.	*Meringium praetervisum.*
H. Preslii Ros.	(*nomen inconditum*)
H. prionema Kunze.	id.
H. procerum v. d. B.	*Sphaerocionium* sp.
H. productoides J. W. Moore.	*Mecodium productoides.*
H. productum Kze.	*Mecodium productum.*
H. protrusum Hooker.	*Mecodium protrusum.*
H. pseudo-tunbridgense Watts.	*Hymenophyllum affine.*
H. pulcherrimum Col.	*Mecodium pulcherrimum.*
H. pulchrum Copel.	*Meringium pulchrum.*
H. pumilio Ross.	id.
H. pumilum C. Moore.	id.
H. punctisorum Ros.	*Mecodium polyanthos.*
H. pusillum Col.	*Hymenophyllum revolutum.*
H. pycnocarpum v. d. B.	*Mecodium polyanthos.*
H. pygmaeum Col.	*Hymenophyllum revolutum.*
H. pyramidatum Desv.	*Sphaerocionium pyramidatum.*
H. pyriforme v. d. B.	*Meringium bivalve.*
H. quadrifidum Phil.	*Meringium magellanicum.*
H. raddianum K. Müller.	*Sphaerocionium raddianum.*
H. Ramosii Copel.	*Meringium Ramosii.*
H. rarum R. Br.	*Mecodium rarum.*
H. recurvum Gaud.	*Mecodium recurvum.*
H. reductum Copel.	*Meringium reductum.*
H. Reinwardtii v. d. B.	*Mecodium Reinwardtii.*
H. remotipinna Bonap.	*Mecodium veronioides.*

H. reniforme Hooker.	*Mecodium reniforme.*
H. retusilobum Hayata.	*Mecodium* sp.
H. revolutum Col.	id.
H. ricciaefolium Bory.	*Meringium tenellum.*
H. Rimbachii Sod.	*Mecodium* sp.
H. ringens Christ.	*Meringium* ?
H. riukiuense Christ.	*Mecodium riukiuense.*
H. Rolandi-Principis Ros.	*Gen. novum ined.*
H. Rosenstockii Brause.	*Meringium Rosenstockii.*
H. rubellum Ros.	*Meringium rubellum.*
H. rufescens Kirk.	*Mecodium rufescens.*
H. rufifolium v. A. v. R.	*Meringium* sp.
H. rufifrons v. A. v. R.	*Meringium* sp.
H. rufum Fée.	*Sphaerocionium rufum.*
H. rugosum C. Chr. and Skottsberg.	id.
H. ruizianum Kze.	*Sphaerocionium ruizianum.*
H. sabinifolium Baker.	*Meringium acanthoides.*
H. salakense Racib.	*Mecodium salakense.*
H. samoense Baker.	*Mecodium samoense.*
H. sampaioanum Brade et Ros.	*Sphaerocionium sampaioanum.*
H. sanguinolentum Sw.	*Mecodium sanguinolentum.*
H. scabrum A. Rich.	*Mecodium scabrum.*
H. secundum H. and G.	*Meringium secundum.*
H. semibivalve H. and G.	*Mecodium rarum.*
H. semifissum Copel.	*Meringium penangianum.*
H. semiglabrum Ros.	*Sphaerocionium semiglabrum.*
H. sericeum Sw.	*Sphaerocionium sericeum.*
H. Serra Presl.	*Meringium secundum.*
H. serrulatum C. Chr.	*Meringium meyenianum.*
H. seselifolium Presl.	id. ?
H. shirleyanum Domin.	*Mecodium samoense.*
H. sibthorpioides Mett.	*Microtrichomanes parvulum.*
H. siliquosum Christ.	*Mecodium siliquosum.*
H. Silveirae Christ.	*Sphaerocionium* sp.
H. simonsianum Hooker.	id.
H. Skottsbergii C. Chr.	*Mecodium* sp.
H. Smithii Hooker.	*Meringium meyenianum.*
H. Sodiroi C. Chr.	*Buesia Sodiroi.*
H. sororium v. d. B.	*Mecodium imbricatum.*
H. spectabile Mett.	*Sphaerocionium spectabile.*
H. sphaerocarpum v. d. B.	*Mecodium polyanthos.*
H. spicatum Christ.	id.
H. splendidum v. d. B.	*Sphaerocionium splendidum.*
H. Sprucei Baker.	*Sphaerocionium* sp.
H. Steerei C. Chr.	*Mecodium fimbriatum.*
H. streptophyllum Fourn.	*Mecodium* sp.
H. subdemissum Christ.	*Mecodium polyanthos.*
H. subdimidiatum Ros.	*Meringium* ?
H. subfirmum v. A. v. R.	*Meringium firmum.*
H. subflabellatum Cesati.	*Meringium Lobbii.*

H. subobtusum Ros.	*Sphaerocionium subobtusum.*
H. subrigidum Christ.	*Sphaerocionium subrigidum.*
H. subrotundum v. A. v. R.	*Meringium denticulatum.*
H. subtilissimum Kunze.	*Sphaerocionium ferrugineum.*
H. tablaziense Christ.	*Mecodium tablaziense.*
H. taliabense v. A. v. R.	*Meringium pachydermicum.*
H. tasmannicum v. d. B.	*Mecodium australe.*
H. tenellum Kuhn.	*Meringium tenellum.*
H. tenerrimum v. d. B.	*Sphaerocionium* sp.
H. tenerum v. d. B.	*Mecodium* sp.
H. Thomassetii C. H. Wright.	id.
H. thuidium Harr.	*Mecodium thuidium.*
H. todjambuense Kjellberg.	*Mecodium* sp.
H. tomentosum Kze.	*Sphaerocionium tomentosum.*
H. torquescens v. d. B.	id.
H. torricellianum v. A. v. R.	*Meringium* sp.
H. tortuosum H. and G.	*Meringium tortuosum.*
H. trapezoidale Liebm.	*Mecodium* sp.
H. Treubii Racib.	*Mecodium Treubii.*
H. Trianae Hieron.	*Mecodium Trianae.*
H. triangulare Baker.	*Meringium triangulare.*
H. trichocaulon Phil.	?
H. trichomanoides v. d. B.	*Mecodium* sp.
H. trichophyllum H. B. K.	*Sphaerocionium trichophyllum.*
H. truncatum Col.	*Meringium multifidum.*
H. tunbridgense (L.) Sw.	id.
H. Ulei Christ and Gies.	*Sphaerocionium* sp.
H. uncinatum Sim.	id.
H. undulatum Sw.	*Mecodium undulatum.*
H. unilaterale Bory.	*Hymenophyllum peltatum.*
H. Urbani Brause.	*Sphaerocionium* sp.
H. vacillans Christ.	?
H. valvatum H. and G.	*Sphaerocionium valvatum.*
H. veronicoides C. Chr.	*Mecodium veronicoides.*
H. villosum Col.	*Mecodium villosum.*
H. vincentinum Baker.	*Mecodium macrothecum.*
H. violaceum Meyen.	*Meringium meyenianum.*
H. viride Ros.	id. ?
H. vittatum Copel.	*Meringium vittatum.*
H. Walleri Maiden and Betche.	*Mecodium Walleri.*
H. Wercklei Christ.	*Sphaerocionium Wercklei.*
H. Wrightii v. d. B.	*Mecodium Wrightii.*
H. zeelandicum v. d. B.	*Hymenophyllum revolutum.*
H. zollingerianum Kunze.	*Amphipterum fuscum.*

TRICHOMANES

T. abrotanifolium v. d. B.	*Vandenboschia* sp.
T. accedens Ph.	id.
T. acrosorum Copel.	*Cephalomanes acrosorum.*
T. acutilobum Ching.	*Crepidomanes* sp.

T. acuto-obtusum Hayata.	*Crepidomanes Makinoi.*
T. acutum Presl.	*Pleuromanes acutum.*
T. adscendens Kze.	id.
T. africanum Christ.	*Vandenboschia* ?
T. alagense Christ.	*Gonocormus alagensis.*
T. alatum Sw.	id.
T. alternans Carr.	*Crepidopteris endlicheriana.*
T. amabile Nakai.	*Vandenboschia radicans.*
T. amazonicum Christ.	id.
T. anadromum Ros.	id.
T. angustatum Carm.	*Macroglena* ?
T. angustimarginatum Bonap.	*Macroglena angustimarginata.*
T. Ankersii Parker.	id.
T. aphlebioides Christ.	*Vandenboschia aphlebioides.*
T. apicilare Fourn.	*Crepidopteris* sp.
T. apiifolium Pr.	*Callistopteris apiifolia.*
T. arbuscula Desv.	id.
T. Asae-Grayi v. d. B.	*Macroglena Asae-Grayi.*
T. asplenioides Presl.	*Cephalomanes oblongifolium.*
T. assimile Mett.	*Gonocormus* ?
T. Aswijkii Racib.	*Microtrichomanes* sp.
T. atrovirens Kunze.	*Cephalomanes atrovirens.*
T. auriculatum Bl.	*Vandenboschia auriculata.*
T. axillare Sod.	*Vandenboschia* sp.
T. badium Fourn.	id.
T. Baldwinii Copel.	*Callistopteris Baldwinii.*
T. barklianum Baker.	*Didymoglossum* ?
T. barnardianum Bailey.	*Crepidomanes* ?
T. batrachoglossum Copel.	*Selenodesmium batrachoglossum.*
T. bauerianum Endl.	*Callistopteris baueriana.*
T. beccarianum Cesati.	*Microgonium beccarianum.*
T. Beckeri Krause.	*Vandenboschia* sp.
T. bicorne Hooker.	id.
T. bilabiatum Nees et Bl.	*Crepidomanes bilabiatum.*
T. bilobatum v. A. v. R.	*Crepidomanes bilobatum.*
T. bimarginatum v. d. B.	*Microgonium bimarginatum.*
T. bipunctatum Poir.	*Crepidomanes bipunctatum.*
T. birmanicum Bedd.	*Vandenboschia radicans.*
T. blepharistomum Copel.	*Nesopteris thysanostoma.*
T. Boivini v. d. B.	*Selenodesmium* (?)
T. Bonapartei C. Chr.	*Gonocormus* sp.
T. bonincolum Nakai.	*Gonocormus* sp.
T. boninense Koidzumi.	*Crepidomanes* sp.
T. borneense v. A. v. R.	*Cephalomanes singaporianum.*
T. boryanum Kunze.	*Cephalomanes boryanum.*
T. botryoides Kaulf.	*Feea botryoides.*
T. brachyblastos Mett.	*Vandenboschia* sp.
T. Bradei Christ.	*Vandenboschia* sp.
T. brevipes Baker.	*Crepidomanes brevipes.*
T. Brooksii Copel.	*Gonocormus* sp.

T. caespitosum Hooker.	*Serpyllopsis caespitosa.*
T. calvescens v. d. B.	*Sphaerocionium Lyallii.*
T. capillaceum L.	*Vandenboschia capillacea.*
T. capillatum Taschner.	*Crepidomanes bilabiatum.*
T. cartilagineum Vieill. et Pancher.	*Selenodesmium dentatum.*
T. caudatum Brack.	*Macroglena caudata.*
T. cellulosum Kl.	*Vandenboschia* sp.
T. Chevalieri Christ.	*Vandenboschia* ?
T. Christii Copel.	*Crepidomanes Christii.*
T. Cocos Christ.	*Vandenboschia* sp.
T. cognatum Cesati.	*Microgonium beccarianum.*
T. Colensoi Hooker f.	*Vandenboschia Colensoi.*
T. compactum v. A. v. R.	*Macroglena compacta.*
T. concinnum Mett.	*Crepidopteris humile.*
T. corcovadense v. d. B.	id.
T. cordifolium Alston.	*Didymoglossum cordifolium.*
T. corticola Bedd.	*Microtrichomanes nitidulum.*
T. crassipilis Weatherby.	id.
T. craspedoneurum Copel.	*Microgonium craspedoneurum.*
T. crassum Copel.	*Cephalomanes.*
T. crinitum Sw.	id.
T. crispum L.	id.
T. cristatum Kaulf.	id.
T. cultratum Baker.	*Microgonium cultratum.*
T. Cumingii C. Chr.	*Abrodictyum Cumingii.*
T. cuneatum Christ.	*Microtrichomanes Francii.*
T. cupressifolium Hayata.	*Vandenboschia latifrons.*
T. cupressoides Desv.	*Selenodesmium cupressoides.*
T. Curranii Weatherby.	id.
T. Curtii Ros.	*Didymoglossum lineolatum.*
T. cuspidatum Willd.	*Microgonium cuspidatum.*
T. cyrtotheca Hilleb.	*Vandenboschia cyrtotheca.*
T. dacylites Sod.	*Vandenboschia* sp.
T. daguense Weatherby.	id.
T. davallioides Gaud.	*Vandenboschia davallioides.*
T. debile v. d. B.	*Vandenboschia* sp.
T. delicatum v. d. B.	id.
T. densinervium Copel.	*Cephalomanes densinervium.*
T. dentatum v. d. B.	*Selenodesmium dentatum.*
T. denticulatum Baker.	*Meringium Bakeri.*
T. diaphanum H. B. K.	*Vandenboschia diaphana.*
T. dichotomum Kze.	*Microtrichomanes dichotomum.*
T. diffusum Bl.	*Gonocormus diffusus.*
T. digitatum Sw.	*Microtrichomanes digitatum.*
T. diversifrons Mett.	*Feea diversifrons.*
T. draytonianum Brack.	*Vandenboschia draytoniana.*
T. elegans Rich.	*Davalliopsis elegans.*
T. elongatum A. Cunn.	*Selenodesmium elongatum.*
T. endlicherianum.	*Crepidopteris endlicheriana.*
T. englerianum Brause.	*Selenodesmium* ?

T. erectum Brack.	*Crepidopteris Endlicheriana.*
T. eriophorum v. d. B.	id.
T. erosum Willd.	*Microgonium erosum.*
T. exiguum Baker.	*Didymoglossum exiguum.*
T. exsectum Kze.	*Vandenboschia exsecta.*
T. extravagans Copel.	*Selenodesmium extravagans.*
T. fallax Christ.	*Vandenboschia fallax.*
T. Fargesii Christ.	*Vandenboschia* sp.
T. ferrugineum Fourn.	*Selenodesmium dentatum* (?)
T. filiculoides Christ.	*Crepidopteris humile.*
T. fimbriatum Backh.	id.
T. flabellatum v. d. B.	*Microtrichomanes* sp.
T. flavo-fuscum v. d. B.	*Macroglena flavo-fusca.*
T. Foersteri Ros.	*Cephalomanes* sp.
T. fontanum Lindm.	*Didymoglossum fontanum.*
T. formosanum Yabe.	*Crepidomanes latemarginale.*
T. Foxworthyi C. Chr.	*Pleuromanes pallidum.*
T. Francii Christ.	*Microtrichomanes Francii.*
T. Frappieri Cord.	?
T. Fraseri Jenman.	*Didymoglossum* sp.
T. fruticulosum Jenm.	*Didymoglossum* sp.
T. fulgens C. Chr.	*Microgonium* sp.
T. furcatum v. d. B.	id.
T. Galeottii Fourn.	id.
T. Gardneri v. d. B.	id.
T. gemmatum J. Sm.	*Macroglena gemmata.*
T. Giesenhagenii C. Chr.	*Didymoglossum* sp.
T. giganteum Bory.	*Vandenboschia* sp.
T. Godmani Hooker.	*Didymoglossum Petersii.*
T. goebelianum Gies.	*Didymoglossum* sp.
T. Goetzii Hieron.	*Vandenboschia* sp.
T. gracile v. d. B.	*Gonocormus* sp.
T. gracillimum Copel.	*Crepidopteris gracillima.*
T. grande Copel.	*Nesopteris grandis.*
T. guianense Sturm.	id.
T. Hartii Baker.	*Vandenboschia* ?
T. Harveyi Carr.	*Nesopteris intermedia.*
T. henzaianum Parish.	*Microgonium henzaianum.*
T. Herzogii Ros.	*Vandenboschia Herzogii.*
T. heterophyllum HBW.	*Feea heterophylla.*
T. Hieronymi Brause.	*Meringium* sp.
T. Hildebrandtii Kuhn.	*Microgonium* ?
T. hispidulum Mett.	*Nesopteris superba.*
T. holopterum Kze.	id.
T. Hookeri Presl.	*Microgonium Hookeri.*
T. Hosei Baker.	*Meringium penangianum.*
T. hostmannianum Kunze.	id.
T. Huberi Christ.	id.
T. humile Forster.	*Crepidopteris humile.*
T. hymenophylloides v. d. B.	*Vandenboschia hymenophylloides.*

T. hymenoides Hedwig.	*Didymoglossum hymenoides.*
T. hypnoides Christ.	*Vandenboschia* sp.
T. ignobile Cesati.	*Nesopteris superba.*
T. imbricatum Sod.	id.
T. infundibulare v. A. v. R.	*Cephalomanes* sp.
T. Ingae C. Chr.	*Vandenboschia Ingae.*
T. insigne Bedd.	*Crepidomanes* sp.
T. intermedium v. d. B.	*Nesopteris intermedia.*
T. intramarginale H. and G.	*Crepidomanes intramarginale.*
T. javanicum Bl.	*Cephalomanes javanicum.*
T. johnstonense Bailey.	*Vandenboschia johnstonensis.*
T. junceum Christ.	*Vandenboschia* sp.
T. jungermannioides Fourn.	*Crepidopteris Vieillardii.*
T. kalamocarpum Hayata.	*Vandenboschia radicans.*
T. Kalbreyeri Baker.	id.
T. kapplerianum Sturm.	*Didymoglossum* sp.
T. Killipii Weatherby.	id.
T. Kingii Copel.	*Cephalomanes Kingii.*
T. Kirkii Hooker.	*Crepidomanes vel Microgonium.*
T. Kraussii H. and G.	*Didymoglossum Kraussii.*
T. Krugii Christ.	*Selenodesmium* sp.
T. Kurzii Bedd.	*Crepidomanes latemarginale.*
T. labiatum Jenman.	*Didymoglossum* sp.
T. laetum v. d. B.	*Macroglena laeta.*
T. lambertianum Hk.	id.
T. lasiophyllum v. A. v. R.	*Meringium* ?
T. latealatum. (v. d. B., *Didymoglossum.*)	*Crepidomanes latealatum.*
T. latemarginale Eaton.	*Crepidomanes latemarginale.*
T. latifrons v. d. B.	*Vandenboschia latifrons.*
T. latilabiatum E. Brown.	*Gonocormus latilabiatus.*
T. latipinnum Copel.	*Selenodesmium obscurum.*
T. latisectum Christ.	*Vandenboschia* sp.
T. Lauterbachii Christ.	*Crepidopteris humile.*
T. laxum Kl.	id.
T. Ledermanni Brause.	*Cephalomanes* sp. (prob. *C. atrovirens.*)
T. Lehmannii Hieron.	*Didymoglossum* sp.
T. Lenormandi v. d. B.	*Crepidomanes* ? *vide sub Microgonio.*
T. Leptophyllum A. Cunn.	*Macroglena stricta.*
T. levissimum Fée.	?
T. liberiense Copel.	*Didymoglossum liberiense.*
T. Lindigii Fourn.	id.
T. lineolatum Hooker.	*Didymoglossum lineolatum.*
T. liukiuense Yabe.	*Vandenboschia radicans.*
T. longicollum v. d. B.	*Selenodesmium longicollum.*
T. longifrons Nakai.	*Vandenboschia* sp.
T. longilabiatum Bonap.	? *Gonocormus* ?
T. lucens Sw.	id.
T. ludovicianum Ros.	id.

T. Luerssenii F. v. M.	*Macroglena laeta.*
T. Lyallii Hooker f.	*Sphaerocionium Lyallii.*
T. Macgillivrayi Baker.	*Meringium Macgillivrayi.*
T. macilentum v. d. B.	id.
T. madagascariense Moore.	*Cephalomanes madagascariense* v. d. B.
T. Majorae Watts.	*Crepidomanes* sp.
T. Makinoi C. Chr.	*Crepidomanes Makinoi.*
T. maluense Brause.	*Cephalomanes* sp.
T. mandioccanum Raddi.	*Selenodesmium mandioccanum.*
T. Mannii Hooker.	*Gonocormus* sp.
T. Martinezi Rovirosa.	*Vandenboschia* sp.
T. Martiusii Presl.	id.
T. Matthewi Christ.	*Microtrichomanes* sp.
T. maximum Bl.	*Vandenboschia maxima.*
T. megistostomum Copel.	*Crepidomanes megistostomum.*
T. meifolium Bory.	*Macroglena meifolia.*
T. melanopus Baker.	*Didymoglossum melanopus.*
T. melanotrichum Schlecht.	*Vandenboschia* sp.
T. membranaceum L.	*Lecanium membranaceum.*
T. Merrillii Copel.	*Macroglena setacea.*
T. Mettenii C. Chr.	*Vandenboschia* ?
T. meyenianum v. d. B.	*Meringium meyenianum.*
T. micayense Hier.	id.
T. microchilum Baker.	*Mecodium polyanthos.*
T. microlirion Copel.	*Crepidomanes Christii.*
T. Milbraedii Brause.	*Vandenboschia* sp.
T. Milnei v. d. B.	*Macroglena caudata.*
T. mindorense Christ.	*Microgonium mindorense.*
T. minimum v. A. v. R.	*Crepidomanes bilabiatum.*
T. minutissimum v. A. v. R.	*Microgonium beccarianum.*
T. minutum Bl.	*Gonocormus minutus.*
T. Miyakei Yabe.	*Vandenboschia* sp.
T. montanum Hooker.	*Didymoglossum Robinsonii.*
T. Mosenii Lindm.	*Didymoglossum Mosenii.*
T. Motleyi v. d. B.	*Microgonium Motleyi.*
T. musolense Brause.	*Gonocormus minutus.*
T. myrioneuron Lindm.	*Didymoglossum myrioneuron.*
T. naseanum Christ.	*Vandenboschia radicans.*
T. Naumannii Kuhn and Luerss.	*Crepidopteris endlicheriana.*
T. nipponicum Nakai.	*Vandenboschia* sp.
T. nitidulum v. d. B.	*Microtrichomanes nitidulum.*
T. novo-guineense Brause.	*Gonocormus* ?
T. nummularium C. Chr.	*Didymoglossum nummularium.*
T. Nymani Christ.	*Crepidomanes Nymani.*
T. obscurum Bl.	*Selenodesmium obscurum.*
T. omphalodes C. Chr.	*Microgonium omphalodes.*
T. opacum v. d. B.	id.
T. orbiculare Christ.	*Didymoglossum* sp.
T. orientale C. Chr.	*Vandenboschia radicans.*
T. ornatulum v. d. B.	id.

T. osmundoides DC.	*Feea osmundoides.*
T. pabstianum K. Müll.	*Didymoglossum pabstianum.*
T. pachyphlebium C. Chr.	*Davalliopsis* ?
T. pallidum Bl.	*Pleuromanes pallidum.*
T. palmatifidum K. Müll.	*Microtrichomanes palmatifidum.*
T. palmicola v. d. B.	*Didymoglossum* sp.
T. palmifolium Hayata.	*Crepidomanes latemarginale.*
T. paniculatum v. A. v. R.	? (*Crepidomanes* ?)
T. papillatum K. Müller.	*Selenodesmium obscurum.*
T. papuanum Brause.	*Microgonium, veris. M. sublimbatum.*
T. paradoxum Domin.	*Didymoglossum* ?
T. parviflorum Poir.	*Macroglena parviflora.*
T. parvulum Poir.	*Microtrichomanes parvulum.*
T. parvulum aliorum.	*Gonocormus minutus.*
T. parvum Copel.	*Vandenboschia parva.*
T. pedicellatum Desv.	id.
T. pellucens Kze.	id.
T. pennatum Kaulf.	*Trichomanes pinnatum.*
T. perpusillum v. A. v. R.	*Crepidopteris* ?
T. pervenulosum v. A. v. R.	*Crepidomanes pervenulosum.*
T. Petersii A. Gray.	*Didymoglossum Petersii.*
T. philippianum Sturm.	*Vandenboschia philippiana.*
T. piliferum v. A. v. R.	*Microtrichomanes* sp.
T. pilosum Raddi.	id.
T. pinnatifidum v. d. B.	id.
T. pinnatinervium Jenman.	*Didymoglossum* sp.
T. pinnatum Hedwig.	id.
T. platyrachis Domin.	*Feea* sp.
T. plicatum Bedd.	*Crepidomanes* sp.
T. Pluma Hooker.	*Macroglena meifolia.*
T. plumosum Kze.	id.
T. Poeppigii Presl.	*Trichomanes polypodioides* ?
T. polyanthum Hooker.	*Callistopteris polyantha.*
T. polyodon Col.	*Selenodesmium elongatum.*
T. polypodioides L.	id.
T. Powellii Baker.	*Microtrichomanes vitiense.*
T. preslianum Nakai.	*Nesopteris grandis.*
T. procerum Fée.	id.
T. proliferum Blume.	*Gonocormus prolifer.*
T. pseudo-arbuscula v. A. v. R.	*Selenodesmium* ?
T. pseudocapillatum v. A. v. R.	*Crepidomanes* sp.
T. pulcherrimum Copel.	*Vandenboschia aphlebioides.*
T. pumilum v. d. B.	*Selenodesmium dentatum* ?
T. punctatum Christ.	*Crepidomanes bipunctatum.*
T. punctatum Poir.	*Didymoglossum punctatum.*
T. pusillum Sw.	*Didymoglossum pusillum.*
T. pygmaeum C. Chr.	*Crepidomanes vel Microgonium.*
T. pyxidiferum L.	*Vandenboschia pyxidifera.*
T. quelpaertense Nakai.	*Vandenboschia radicans.*

T. racemulosum v. d. B.	*Selenodesmium obscurum.*
T. radicans Sw.	*Vandenboschia radicans.*
T. recedens Ros.	*Crepidomanes Christii.*
T. reniforme Forster.	*Cardiomanes reniforme.*
T. reptans Sw.	*Didymoglossum reptans.*
T. rhizophyllum Slosson.	*Didymoglossum* sp.
T. rhomboideum J. Sm.	*Cephalomanes atrovirens.*
(*C. rhomboideum* v. d. B. =	*C. javanicum.*)
T. Ridleyi Copel.	*Microtrichomanes Ridleyi.*
T. rigidum Sw.	*Selenodesmium rigidum.*
T. Robinsoni Baker.	*Didymoglossum Robinsonii.*
T. robustum Fourn.	id.
T. roemerianum Ros.	? (*Meringium* ?).
T. roraimense Jenman.	?
T. Rosenstockii v. A. v. R.	*Cephalomanes singaporianum.*
T. Rothertii v. A. v. R.	*Crepidomanes Rothertii.*
T. rotundifolium Bonap.	*Microgonium cuspidatum.*
T. rupestre v. d. B.	id.
T. rupicolum Racib.	*Crepidomanes rupicolum.*
T. savaiense Lauterb.	*Pleuromanes pallidum.*
T. saxatile Moore.	*Selenodesmium obscurum.*
T. saxifragoides Presl.	*Gonocormus minutus.*
T. Sayeri F. Müller and Baker.	*Microgonium* sp.
T. scandens L.	*Vandenboschia scandens.*
T. Schlechteri Brause.	*Macroglena Schlechteri.*
T. schmidianum Zenker.	*Vandenboschia schmidiana.*
T. schomburgkianum Sturm.	*Trichomanes pinnatum.*
T. Schultzei Brause.	*Macroglena* sp.
T. Seemanni Carr.	*Selenedesmium dentatum.*
T. sellowianum Presl.	id.
T. serratifolium Ros.	*Vandenboschia serratifolia.*
T. serratulum Baker.	*Meringium Lobbii.*
T. setaceum v. d. B.	*Macroglena setacea.*
T. setiferum Baker.	*Didymoglossum* sp.
T. siamense Christ.	*Selenodesmium obscurum.*
T. sibthorpioides Bory.	*Microtrichomanes parvulum.*
T. singaporianum v. A. v. R.	*Cephalomanes singaporianum.*
T. sinuatum Bonap.	*Vandenboschia* sp.
T. sociale Lindm.	*Didymoglossum sociale.*
T. societense J. W. Moore.	*Callistopteris polyantha.*
T. solitarium Jenman.	*Didymoglossum punctatum.*
T. Somai Nakai.	*Vandenboschia* sp.
T. speciosum Willd.	*Vandenboschia* sp.
T. sphenoides Kunze.	*Didymoglossum sphenoides.*
T. spinulosum Phil.	*Leptocionium dicranotrichum.*
T. stenosiphon Christ.	*Vandenboschia stenosiphon.*
T. strictum Menzies.	*Macroglena stricta.*
T. stylosum Poir.	*Selenodesmium stylosum.*
T. subdeltoideum C. Chr.	? (*Macroglena* ?).
T. sublabiatum v. d. B.	id.

T. sublimbatum K. Müller.	*Microgonium sublimbatum.*
T. subpinnatifidum v. d. B.	*Gonocormus minutus.*
T. subtilissimum Brause.	*Gonocormus* sp.
T. subtrifidum Matthew and Christ.	*Gonocormus minutus.*
T. suffrutex v. A. v. R.	*Cephalomanes* sp.
T. sumatranum v. A. v. R.	*Cephalomanes sumatranum.*
T. superbum Backh.	*Nesopteris superba.*
T. taeniatum Copel.	*Microtrichomanes taeniatum.*
T. tamarisciforme Jacq.	*Selenodesmium* sp.
T. tanaicum Hooker.	id.
T. tenerum Spr.	*Vandenboschia tenera.*
T. tenue Brack.	*Crepidopteris endlicheriana.*
T. tenuissimum v. d. B.	*Vandenboschia* sp.
T. tereticaulum Ching.	*Selenodesmium tereticaulum.*
T. Teysmannii v. d. B.	*Gonocormus Teysmannii.*
T. thysanostomum Mak.	*Nesopteris thysanostoma.*
T. Tosae Christ.	*Crepidomanes Makinoi.*
T. trichophorum v. A. v. R.	*Meringium* sp.
T. trichophyllum Moore.	*Macroglena setacea* ?
T. trigonum Desv.	id.
T. trinerve Baker.	*Gonocormus* sp.
T. Trollii Bergdolt.	*Feea Trollii.*
T. Türckheimii Christ.	id.
T. Ujhelyii Kümmerle.	*Trichomanes polypodioides.*
T. Ulei Christ.	*Vandenboschia* sp.
T. varians v. A. v. R.	*Microgonium bimarginatum.*
T. Vaupelii Brause.	*Crepidopteris* sp.
T. venosum R. Br.	*Polyphlebium venosum.*
T. venulosum Copel.	*Crepidomanes venulosum.*
T. vestitum Baker.	*Meringium pachydermicum.*
T. Vieillardii v. d. B.	*Crepidopteris Vieillardii.*
T. virgatulum v. d. B.	*Vandenboschia* sp.
T. viridans Mett.	*Crepidomanes latemarginale.*
T. vitiense Baker.	*Microtrichomanes vitiense.*
T. Vittaria D. C.	id.
T. Walleri Watts.	*Crepidomanes* ?
T. Wallii Thwaites.	*Didymoglossum Wallii.*
T. Warburgii Christ.	*Selenodesmium* ?
T. Werneri Ros.	*Crepidopteris Werneri.*
T. Wildii Bailey.	*Vandenboschia* ?

ILLUSTRATIONS

[The plates illustrate only those genera not illustrated in my treatises on Trichomanes and Hymenophyllum. The drawings are by Alicbusan.]

Plate 1

Apteropteris Malingii (Hooker) Copel., *l, Th. Ranft. 1*, Frond, × 0.5; *2*, transverse section of segment, × 235; *3*, sorus, laid open, × 29; *4*, sporangium, × 77.

Plate 2

Buesia Sodiroi (C. Chr.) Copel., *l. Rimbach. 1*, Frond, × 0.5; *2*, cells, × 380; *3*, sorus, × 14.5; *4*, receptacle, × 14.5; *5*, sporangium, × 77.

Plate 3

Leptocionium dicranotrichum Presl, *l. Gundhel. 1*, Frond, × 1.5; *2*, hairs, × 77; *3*, cells, × 380; *4*, sorus, × 29; *5*, sporangium, × 77.

Plate 4

Serpyllopsis caespitosa (Gaud.) C. Chr., *l. Capt. Dow, ex* U. S. Nat. Herb. *1*, Plant, × 1.5; *2*, cells, × 380; *3*, trichome, × 77; *4*, sorus, × 29; *5*, sporangium, × 77.

Plate 5

Hymenoglossum cruentum (Cav.) Presl, *l. p. Claude Joseph, ex* Herb. Univ. Calif. *1*, Frond, × 0.5; *2*, cells, surface view, × 380; *3*, transverse section of margin of frond, × 235; *4*, sorus, × 29; *5*, receptacle, × 29; *6*, sporangium, × 77.

Plate 6

Cardomanes reniforme (Forster) Presl, *l. Th. Ranft. 1*, Frond, × 0.5; *2*, cells, surface view, × 380; *3*, transverse section, × 235; *4*, sorus, × 29; *5*, sporangium, × 77.

Plate 7

Polyphlebium venosum (R. Br.) Copel., *l, Th. Ranft. 1 and 2*, Frond, × 1; *3*, cells, × 380; *4*, sorus, × 29; *5*, receptacle, × 14.5; *6*, sporangium, × 77.

Plate 8

Trichomanes crispum L., *l. Underwood*, in Jamaica. *1*, Frond, × 0.33; *2*, cells, × 253.3; *3*, sorus, × 19.3; *4*, sporangium, × 51.3.

PLATE 9

Feea osmundoides (DC.) Copel., *l. Tonduz*, in Costa Rica, *ex* Herb. Univ. Calif. *1*, Frond, × 0.5; *2*, cells, × 235; *3*, sorus, × 29; *4*, sporangium, × 77.

PLATE 10

Lecanium membranaceum (L.) Presl, *l. D. Watt*, in Jamaica. *1 and 2*, Frond, × 0.5; *3*, marginal scale, × 38.5; *4*, cells, surface view, × 380; *5*, transverse section, × 235; *6*, sorus, × 14.5; *7*, sporangium, × 77.

PLATE 11

Davalliopsis elegans (Rich.) Copel., *l. Bauer*, in Brazil (Bahia). *1*, Frond, × 0.33; *2*, cells, surface view, × 253.3; *3*, transverse section, × 156.6; *4*, sorus, × 19.3; *5*, sporangium, × 51.3.

TEXT FIGURE

Diagram of affinities of genera.

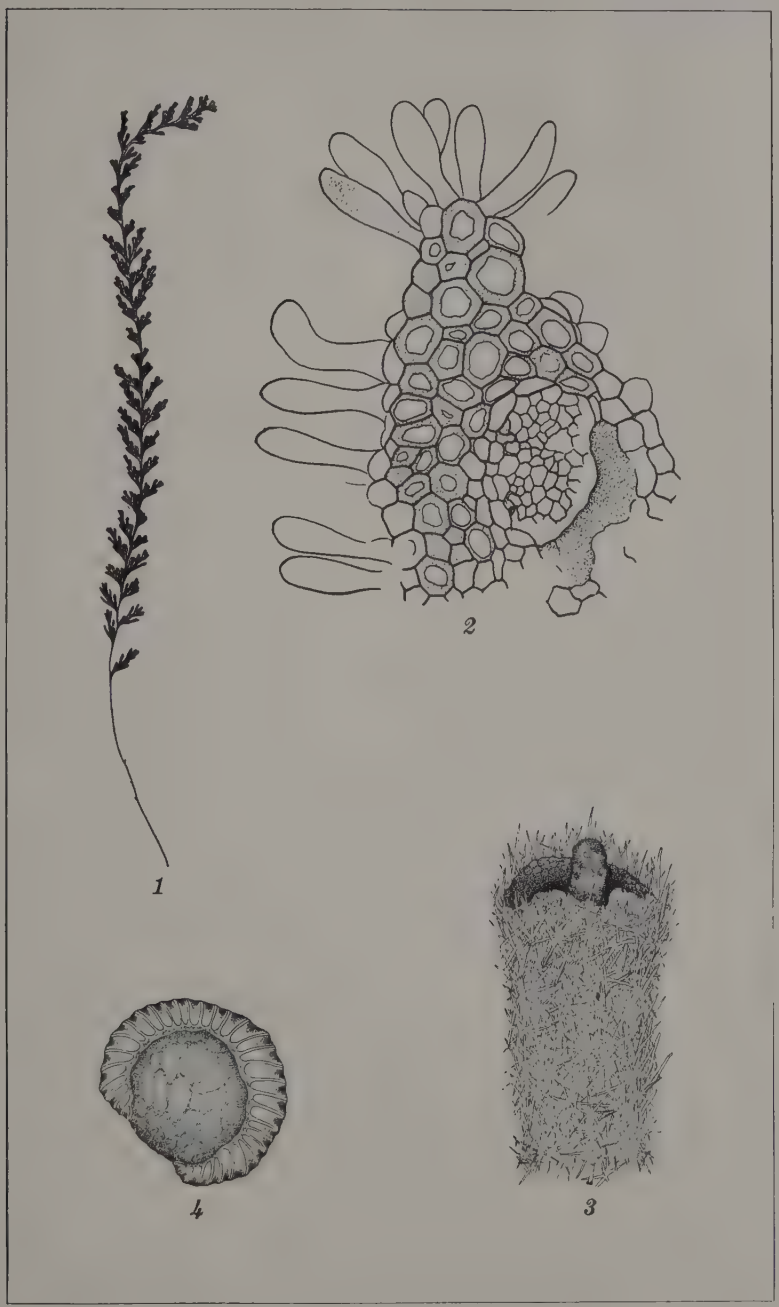
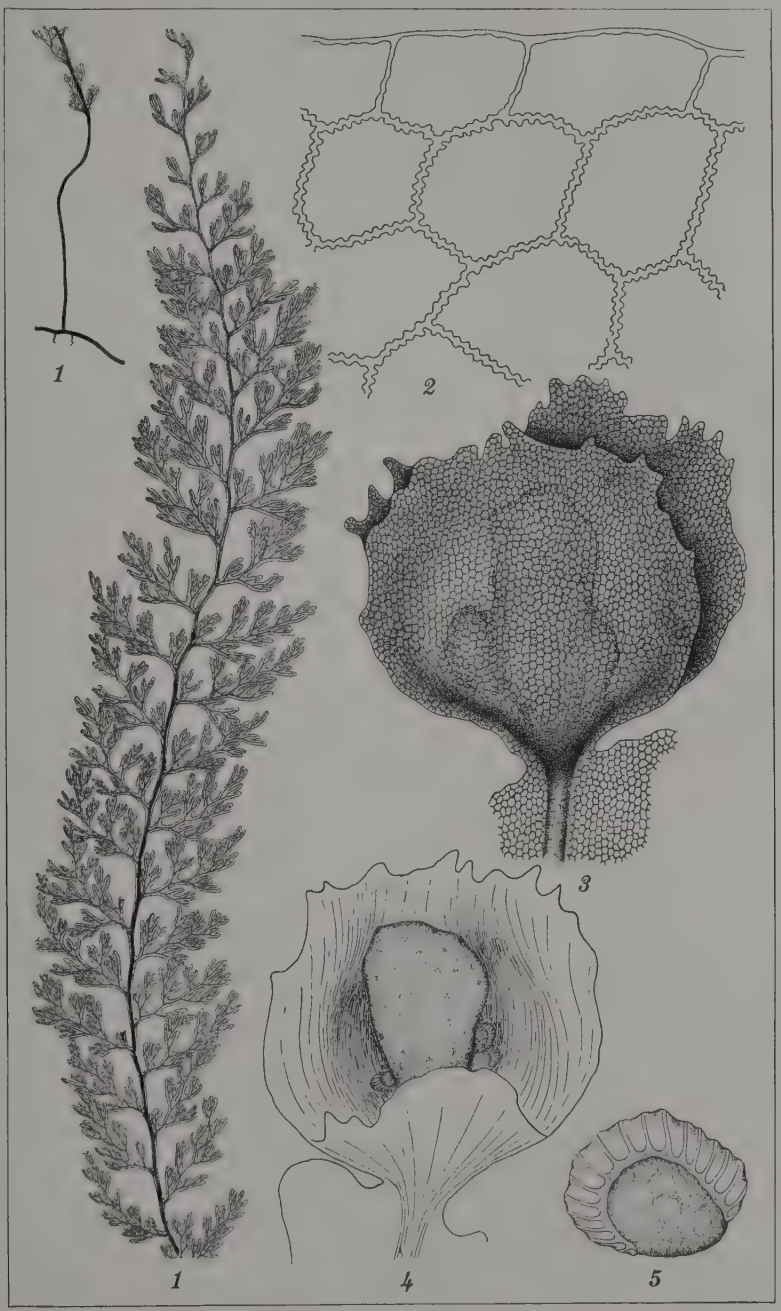


PLATE 1.



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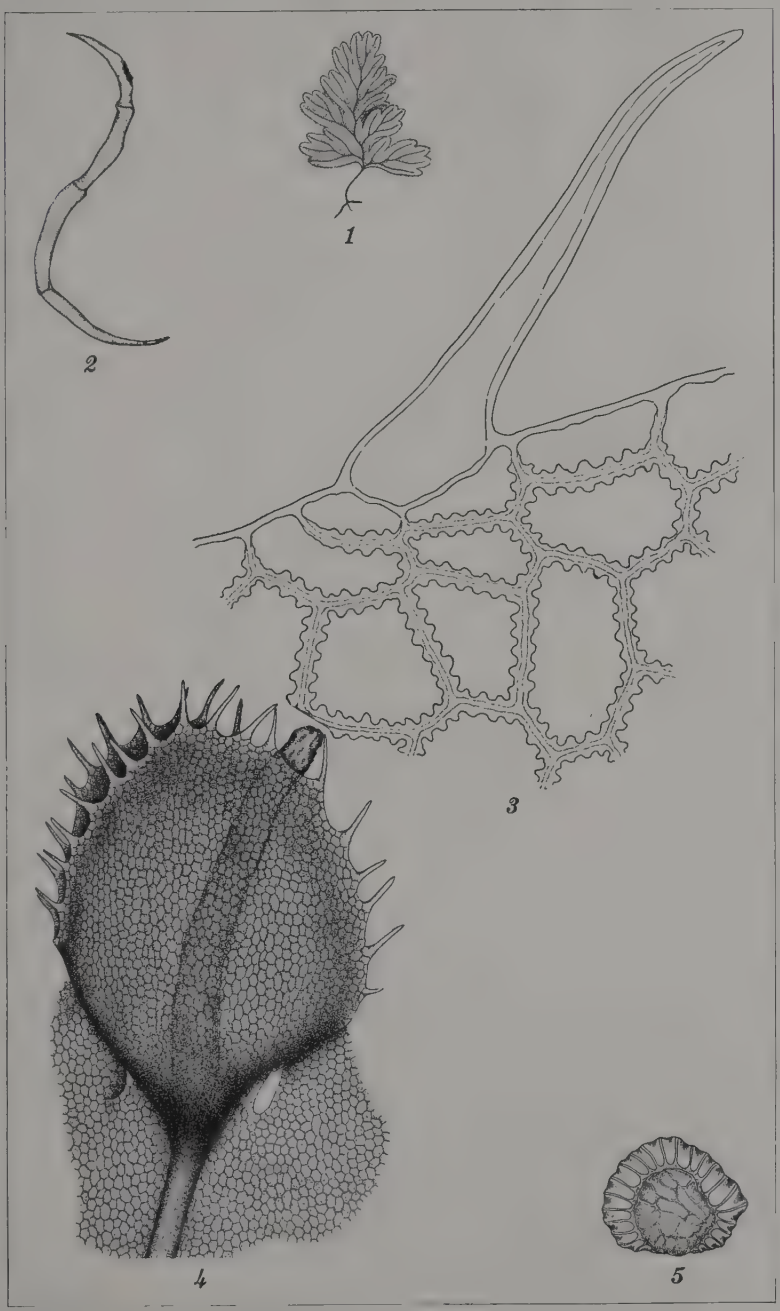
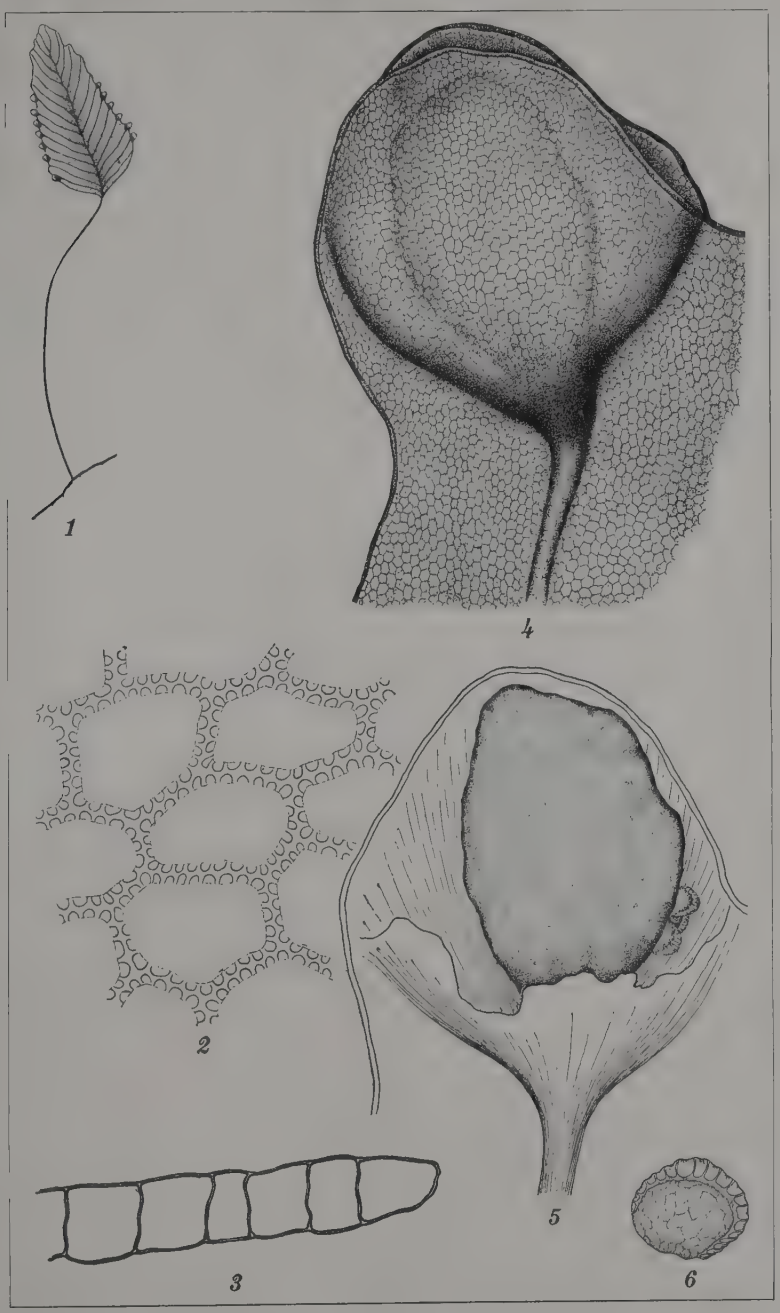


PLATE 3.

PLATE 4.



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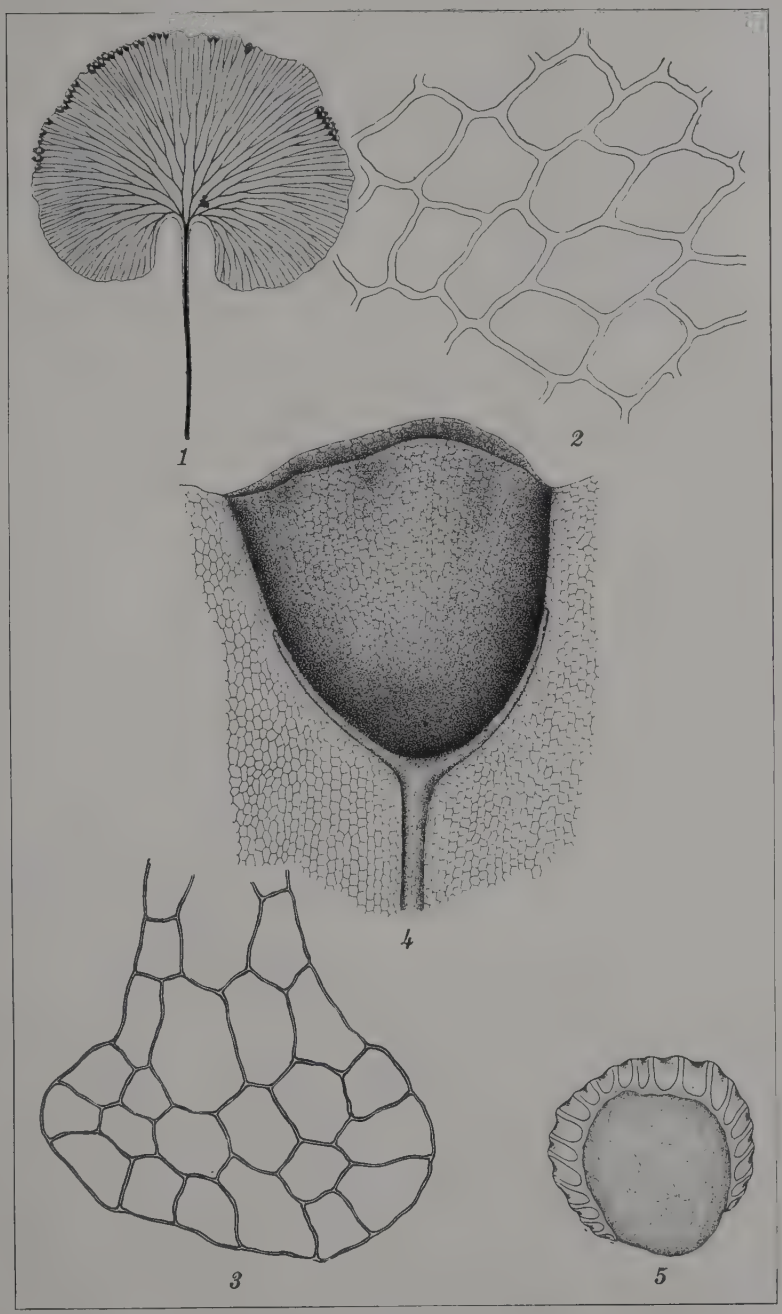

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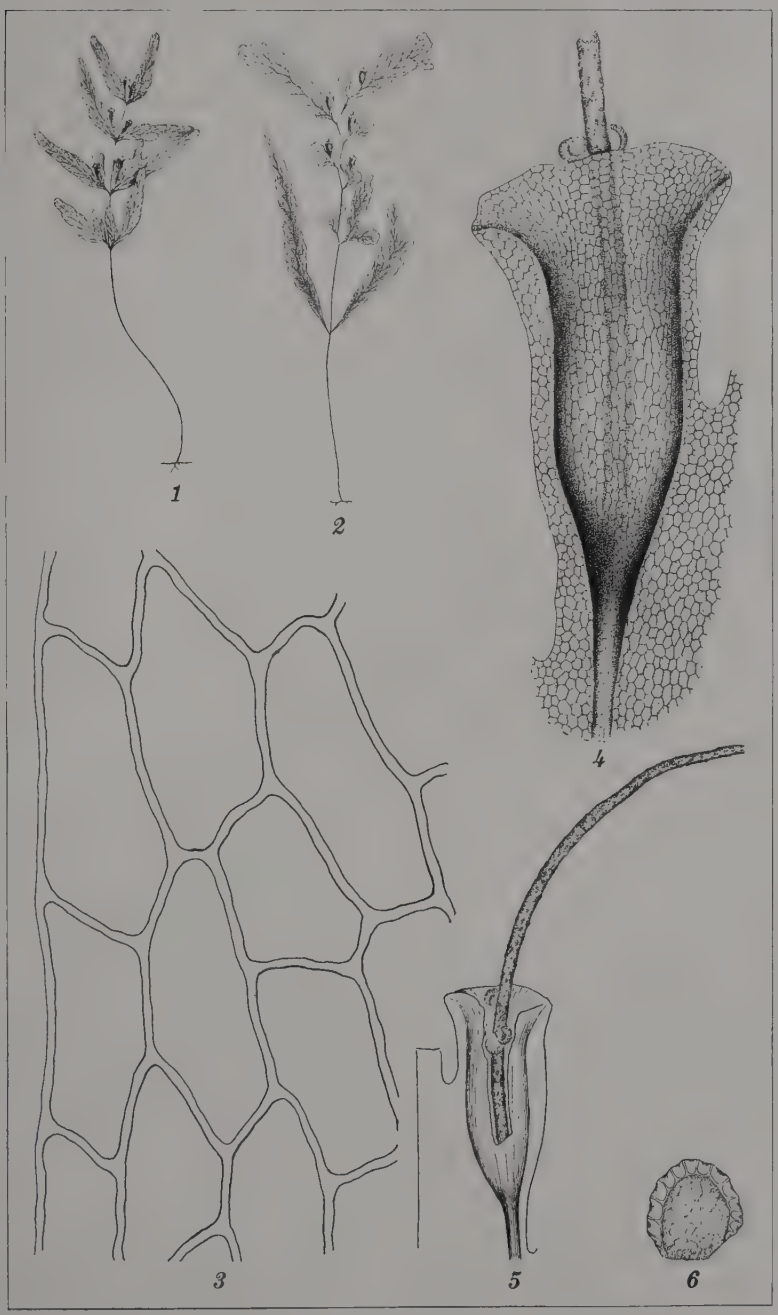

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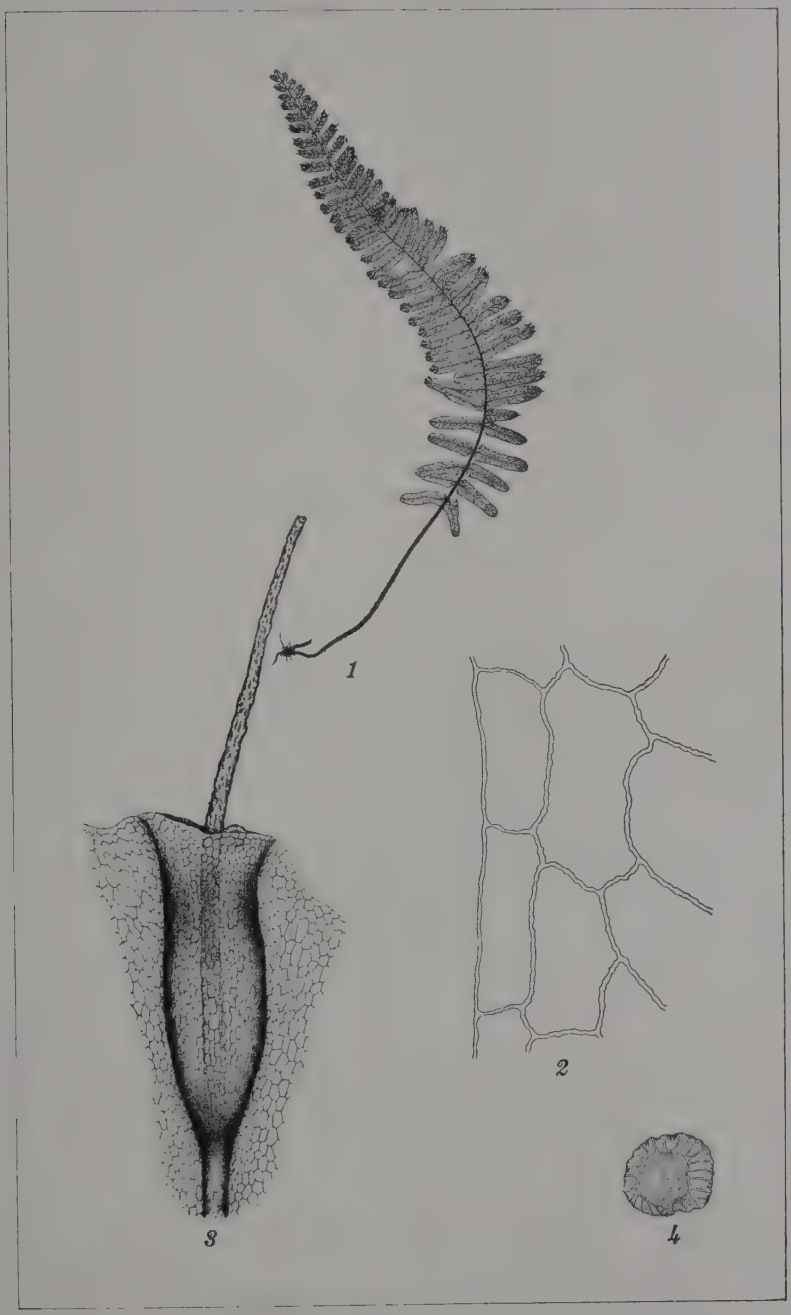

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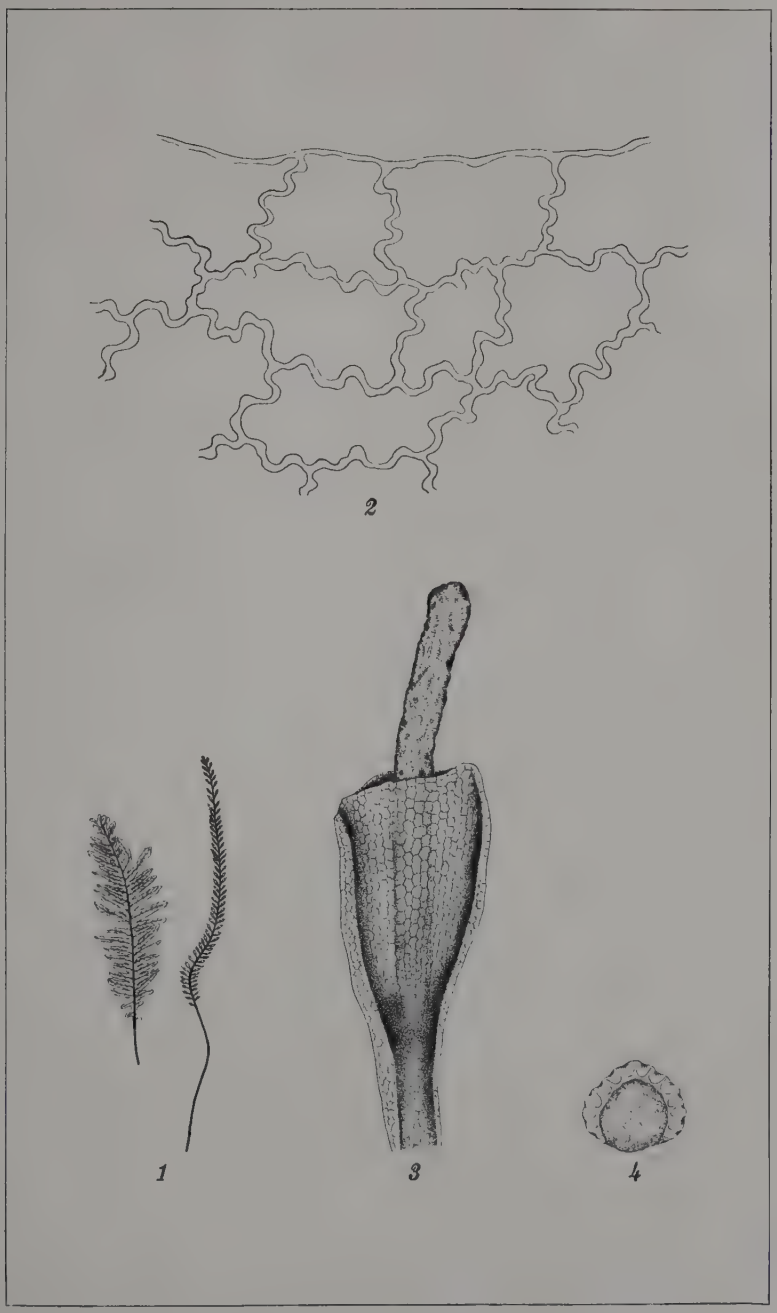

PLATE 9.

1

2

3

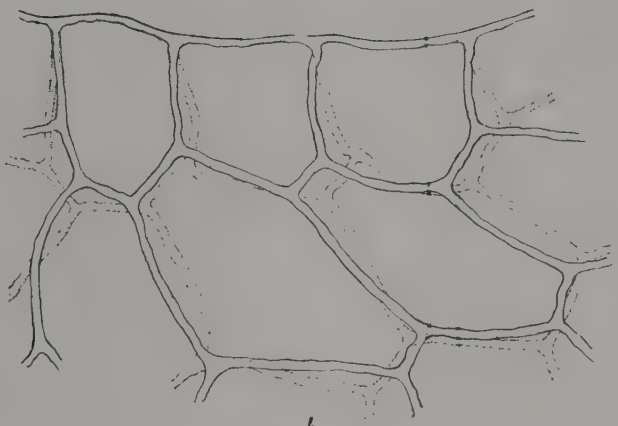

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PLATE 10.

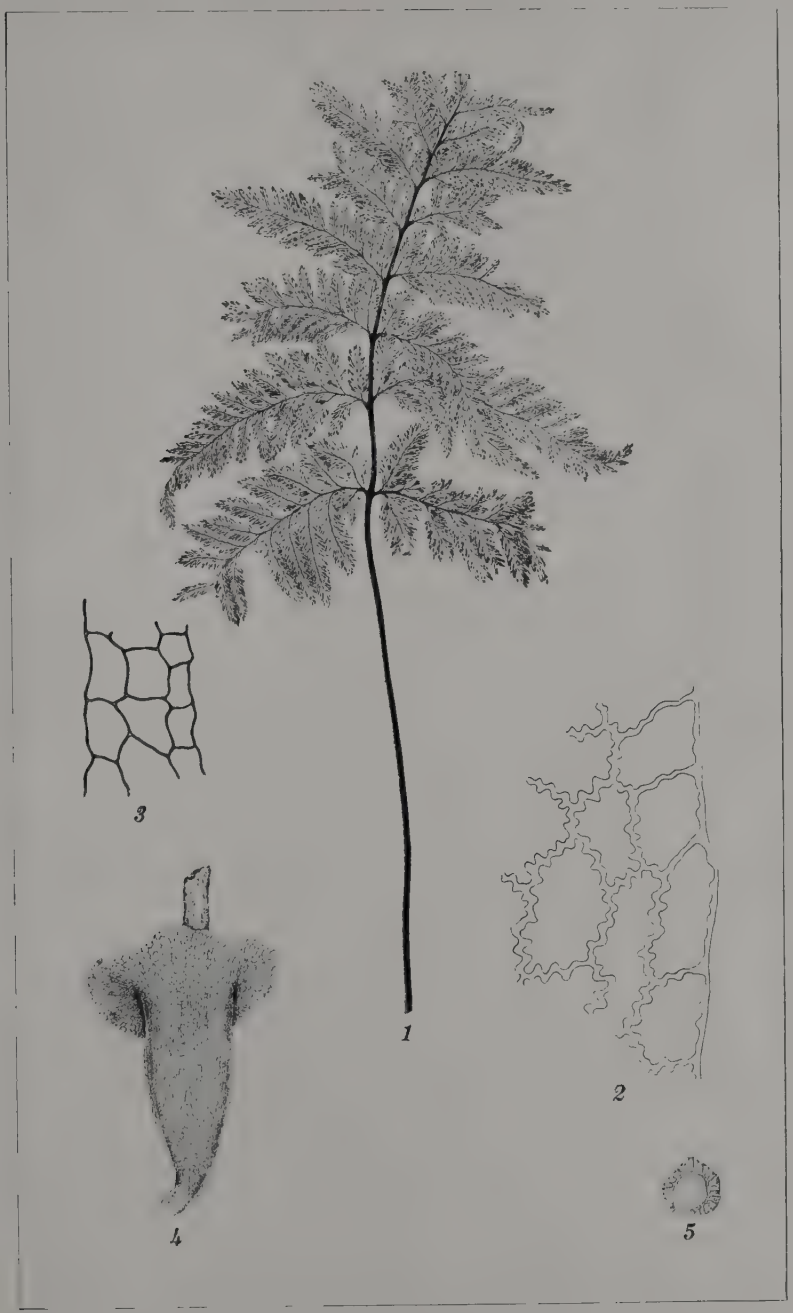

PLATE 11.

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CONTENTS

	Page
COPELAND, EDWIN BINGHAM. Genera Hymenophyllacearum....	1

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